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CORNELL UNIVERSITY MEDICAL BULLETIN

VOLUME XIII NUMBER 1

JULY, 1923

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STUDIES FROM THE Department of SURGERY

1920/23

PUBLISHED BY CORNELL UNIVERSITY
477 FIRST AVENUE
NEW YORK CITY

CORNELL UNIVERSITY MEDICAL BULLETIN

Issued Quarterly

Entered as Second Class Matter, June 13, 1911, at the Post Office, at New York, N. Y., under the Act of August 24, 1921

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized

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These publications include
The Annual Announcement of the Medical College and
Reprinted Studies from the Several Departments of the Medical College and its Research Laboratories

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REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
SEPTEMBER, 1921.

STANDARDIZED RESULTS OF WOUND HEALING*

BY CHARLES L. GIBSON, M.D.,
OF NEW YORK, N. Y.
SURGEON TO THE FIRST (CORNELL) SURGICAL DIVISION OF THE NEW YORK HOSPITAL

THIS study is an attempt to systematize the records of wound healing by the adoption of a standard which aims at a greater degree of accuracy than usually obtains. It also seeks the causes of imperfect wound healing and to correct such accidents.

Our studies have extended over a period of years and the methods we now employ represent the successive stages of what we believe is a more correct method of investigation. In our early attempts a graphic chart of the weekly results was kept, but later abandoned for a monthly record which more nearly eliminates the statistical fallacies.

The facts and figures which we now present are based on the monthly record from January 1, 1920, to July 1, 1921. They represent only a small portion of our clinical material, as it was thought wisest to stand or fall by a limited group of what might be called ideal cases, that is, presenting no conditions of possible infection from the disease itself. For this record, therefore, all such cases as acute appendicitis, any form of salpingitis, any wound that is drained, is not included in our computation. Originally we graded the operations on the stomach and duodenum, but have not included these in our more recent statistics, for it seemed unwise to include these cases which do not represent the same conditions as the bulk of material, more particularly on account of the impaired nutrition of the patients before operation and during convalescence.

Out of 2277 cases admitted to the First Surgical Division only 437 were classified as to wound healing. The main class of cases on which grades were given is as follows: All hernia except strangulated; cholelithiasis without drainage; bones (amputations, open reductions and bone grafts); benign tumors (fibroid uterus, cystoma of ovary, dermoid cyst of scalp); laparotomies for malposition of uterus; adhesions of peritoneum; chronic mastitis; varicose veins; chronic appendicitis, etc.

Manner of Tabulating Results.—The material is divided into three groups: Grade I represents absolutely irreproachable wound healing; Grade II small disturbances of wound healing, such as small hæmatoma or trivial infection, but none of these accidents delaying wound healing beyond the usual normal period; Grade III all other cases, that is, all infections.

We feel it is particularly important to differentiate between hæmatomata, classified under Grade II, and infections, Grade III, as the Grade II mishaps

* Read before the American Surgical Association, June 15, 1921. Published paper contains figures up to July 1, 1921.

are more apt to represent individual errors while Grade III may well be laid to a faulty system.

Manner of Giving Ratings.—With rare exceptions the ratings are given by me personally. During my absence in the summer no accurate record has been kept of results. Ratings are made on weekly "Field Rounds." If wounds are definitely healed, say at the end of seven or eight days, the grade given is usually final. If the rating is given, say at four or five days, a note is given that the final result must be checked up and is so checked up by me the following week.

These notes are all given in the presence of the Staff at "Field Rounds," and if any possible dissension exists the grade is given according to the consensus of opinion. Occasions for such discussion, however, are almost unknown at present, which indicates that our present system is simple and efficient. At the end of the month results are tabulated as indicated on the charts (Figs. 1 and 2).

In addition to the notes made at the weekly rounds, the results of wound healing are discussed at the weekly staff conference which follows weekly rounds. At this conference explanations for disturbances of wound healing are sought and given and decisions are taken which may influence subsequent procedures. Records are also kept of changes in the staff, both nurses and internes, and the dates of changes of procedures and technic are indicated.

Results.—Out of 437 cases classified as to wound healing there were 39 (9 per cent.) with disturbances of wound healing. These were divided as follows: Grade II, 25, or 6 per cent.; Grade III, 14, or 3 per cent.

The following main classifications are given, showing results of wound healing:

Diagnosis	No. of cases recorded	Disturbances of wound healing	Grade II	Grade III
Inguinal hernia	172	14 (8 per cent.)	8 (5 per cent.)	6 (3 per cent.)
Chronic appendix	90	6 (6 per cent.)	4 (4 per cent.)	2 (2 per cent.)
Bone cases	25	4 (16 per cent.)	4 (16 per cent.)	0
Fibroid uterus	19	1 (5 per cent.)	0	1 (5 per cent.)
Malposition of uterus ...	14	1 (7 per cent.)	1 (7 per cent.)	0
Femoral hernia	13	1 (7 per cent.)	0	1 (7 per cent.)
Incisional hernia	12	2 (16 per cent.)	1 (8 per cent.)	1 (8 per cent.)
Varicose veins	10	1 (10 per cent.)	1 (10 per cent.)	0
Adhesions	8	2 (25 per cent.)	1 (12.5 per cent.)	1 (12.5 per cent.)

It will be noted that the main classes are of inguinal hernia and chronic appendicitis. We have long realized that in inguinal hernia we can expect a moderate number of disturbances notwithstanding our constant efforts to minimize them. Of late we have redoubled our energies as regards preliminary cleansing of the skin of these patients, and our latest technical improvement consists in suturing the aponeurosis to the external oblique with interrupted sutures instead of continuous, thereby lessening the danger of disturbance of the circulation and, in addition, turning in the knots of the sutures toward the deep surface of the wound.

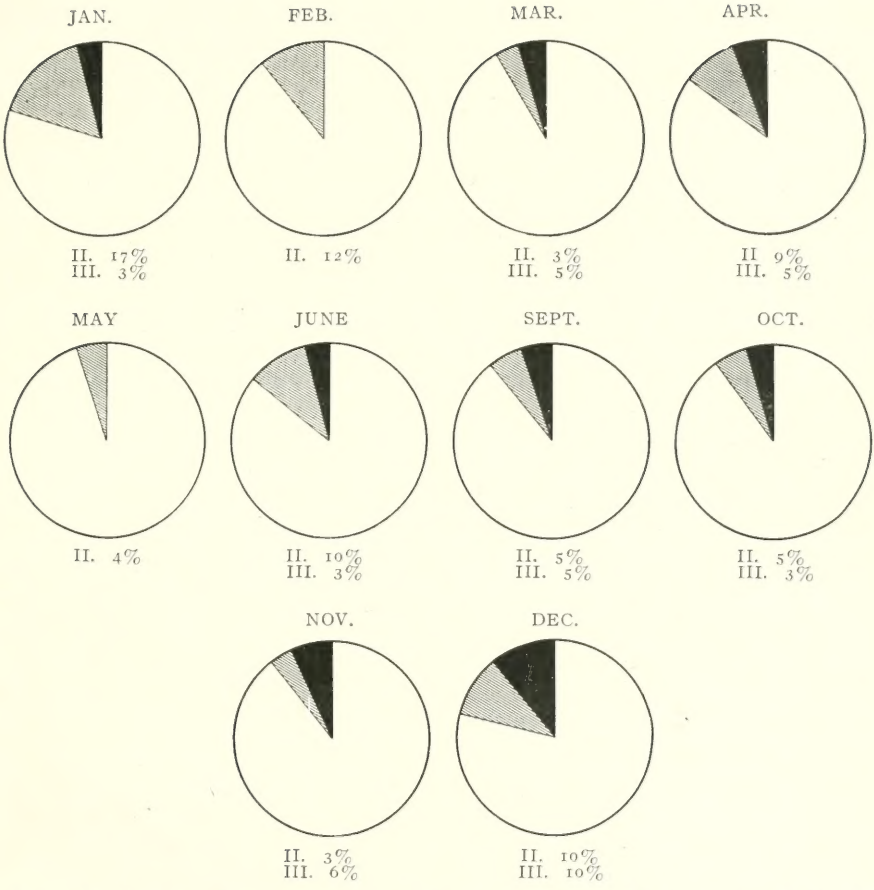

FIG. 1.—Results of wound healing—1920. Class I. (white) Ideal wound healing. Class II. (shaded) Slight Mishaps. No detriment to wound healing. Class III. (black). All Infections.

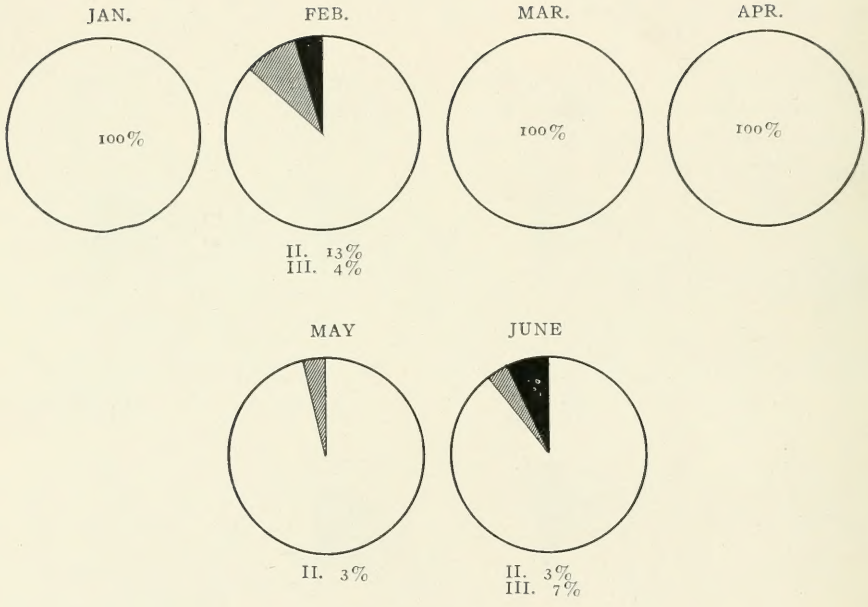

FIG. 2.--Results of wound healing--1921.

An interesting point is in regard to the removal of the appendix in the course of operations for right inguinal hernia. It is our custom to do so when the appendix can be easily brought into view and its removal performed without possible trauma. The following tabulation is rather interesting in that it does not give support to the view that removal of the appendix is a possible source of contamination. This view, I am informed, was held in the army and at one period orders were issued forbidding this procedure.†

TABULATION OF HERNIA OPERATIONS

Since January 1, 1917:

	Per cent.
666 hernia with 33 infections	4.95
506 hernia without appendectomies—26 infections	5.13
160 hernia with appendectomies—7 infections	4.37
203 right hernia without appendectomies—14 infections	6.89
303 left hernia—12 infections	3.96
363 right hernia—21 infections	5.78

One case of acute appendicitis with small abscess was removed through hernial wound. Primary union.

One case of abscess base of appendix opened above. Hernial wound healed by primary union.

Other Factors.—A study also is being made of the results according to the nationality, age and sex of the patient. So far we do not feel justified in drawing any conclusions. We find that at present 80 per cent. of our patients are foreign born, and it will be readily understood that, as these patients include many recent immigrants, standards of health, nutrition, and cleanliness must be somewhat lower than we would desire.

Preparation of the Skin.—Since the fall of 1918 we have replaced tincture of iodine by picric acid 5 per cent. alcoholic solution and continue to be well pleased with it. We believe our results justify our confidence in its antiseptic qualities and its use has been entirely free from the occasional irritation produced by tincture of iodine. Moreover, we have reason to believe that picric acid, if carried into the peritoneum, causes less damage than tincture of iodine.‡

In employing picric acid we have no hesitation in using "wet preparation" and the patients are scrubbed and shaved with soap lather. With the exception of hernia, no other form of antiseptic is used.

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† Information furnished by Dr. W. A. Downes.

‡ "The Advantages of Picric Acid Over Tincture of Iodine for Disinfection of Skin," Charles L. Gibson. ANNALS OF SURGERY, February, 1919.

"Picric Acid in Operative Surgery," Charles E. Farr. ANNALS OF SURGERY, January, 1921.

"The Results of Operations for Chronic Appendicitis," Charles L. Gibson. *American Journal of the Medical Sciences,* May, 1920.

CONCLUSIONS

This paper is not intended to exploit our results and we wish again to insist that the operations here reported do not represent our total series but merely a limited group of cases which we believe is a fair index of our probable results. What we wish to emphasize is the great importance in a hospital service of carrying out systematically and continuously such an investigation. The psychical stimulus and interest are most pronounced and helpful.

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
April, 1921.

THE RUBBER DAM MIKULICZ TAMPON

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A brief description of this method of drainage was made in my article on "Post-operative Intestinal Obstruction" in the Annals of Surgery, April, 1916.

I have employed this device for over twenty years. The use of dental

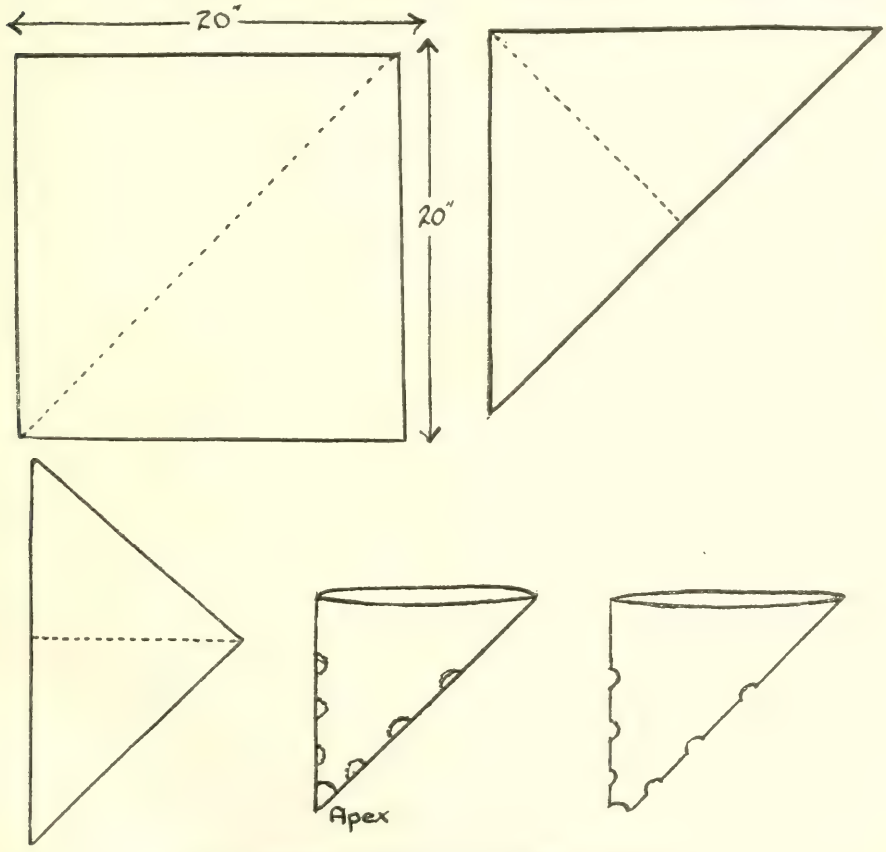

Fig. 1.—Diagrams showing folding and cutting of rubber dam.

rubber dam as drainage material was first suggested to me by Dr. C. A. Porter, of Boston. Originally it was employed by him and by me in certain cases of cellulitis, particularly of the hand, in which the use of gauze packing possesses obvious disadvantages and is painful.

I have modified the Mikulicz tampon by making the outer enveloping layer out of dental rubber dam. A square of rubber dam of suitable size, say 20 by 20 inches in the case of a large retrocecal appendiceal abscess, is folded two or three times in the form of a cornucopia. The apex, which will eventually be the lowest point of the dam, is snipped off, making the hole the size of the little finger. An inch and a half above this the edges of the cornucopia are cut out, making a perforation about one-half inch in size (Figs. 1 and 2). In some cases a second row of perforations is cut about one inch higher up. The tampon is then introduced as follows:

After the appendix has been removed and the cavity sponged out of all purulent material and blood, the operator carries the tampon into the cavity,

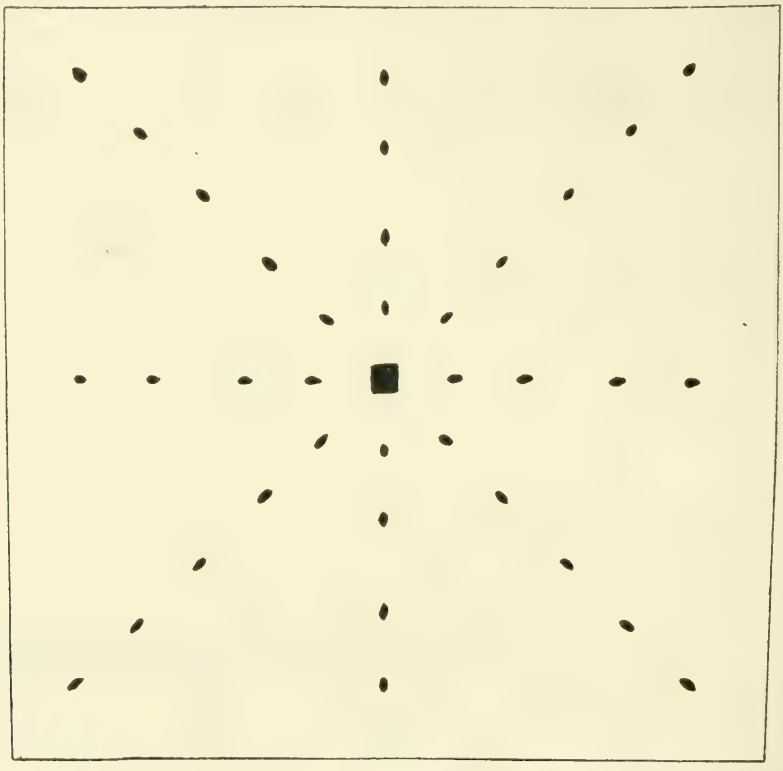

FIG. 2.—Showing distribution of holes.

the index finger being placed at its apex (Fig. 3). The pads and retractors are still in place. The edges of the rubber dam are spread out and while the operator still keeps his finger on the apex, the tampon is filled with strips of packing. I generally "overstuff" the cavity in order to push the omentum and gut well away from the incision in the abdominal wall (Figs. 4 and 5). A large loose dressing is applied. At the end of twenty-four hours the outer dressing is removed. The tampon is usually not disturbed that day, although the gauze packing may be partially withdrawn in order to allow a little better

FIG. 3.—Method of introduction of tampon.

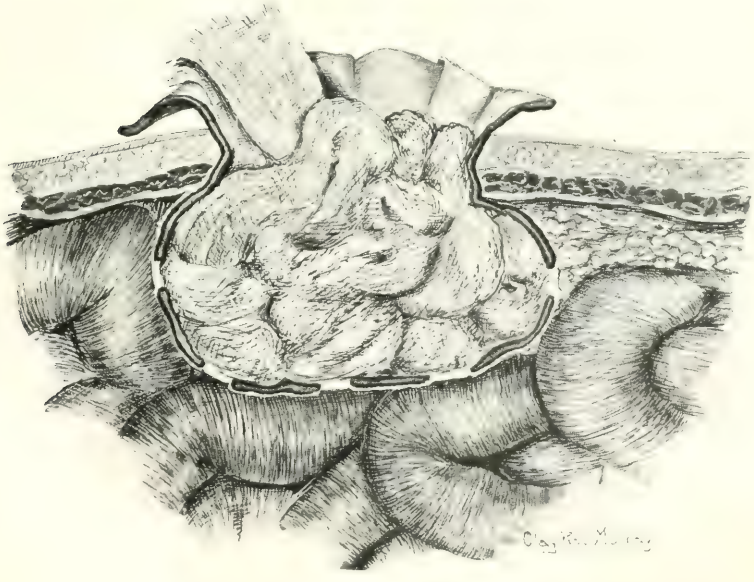

FIG. 4.—Rubber dam Mikulicz tampon.

FIG. 5.—Modified tampon in situ.

drainage by loosening the dressing. At the end of another forty-eight hours the gauze is all removed. Then one of two things may be done; either the tampon is also removed or it is left in place and a small amount of fresh gauze reintroduced. At the end of seventy-two hours the original tampon should be entirely removed. By that time the rubber dam will have become quite smelly.

At this period one of the principal advantages of using the tampon will have been obtained; namely, the permanent pushing back of the abdominal contents from the wound cavity, and there is now left a well-defined, walled-off cavity which can be drained with great ease. There is, moreover, no longer need for the free "wide-open" drainage, and the cavity can be drained by inserting a small piece of rubber dam folded on itself two or three times. This piece of rubber dam is generally removed in the course of a day or two, and the Carrel-Dakin treatment instituted under ideal conditions.

An abscess treated as described above drains in a marvellous fashion. The fluid readily escapes both alongside the rubber dam and by capillary drainage through the loosely packed gauze. The intraäbdominal contents are kept back with a minimum of trauma and irritation. The removal of the gauze and the tampon itself is absolutely painless, a factor to which I attach the highest importance.

In cases of a large neglected abscess it is my custom to rely largely upon this large tampon and not use any sutures in the abdominal wall. Sutures in the abdominal wall have two disadvantages: (1) Stitch holes are likely to become infected and be of themselves a complication, and (2) by locking up of the fascial planes, which are likely to become infected, secondary infection of the abdominal wall with necrosis of the fascia and sloughing may occur.

By the omission of sutures and reliance on the tampon, we have for the most part a wound which has absolutely no reaction and is absolutely painless. In fact, we have the impression that the convalescence of patients treated in this way is very much more comfortable than by other methods.

As the wound closes the abdominal walls can come together over the abdominal contents; that is, these, having been held back at the outset, will not intrude into the wound as a wedge. We are under the impression that these wounds do not give rise to so bad herniæ as do wounds drained in the usual fashion.

Extracted from the American Journal of the Medical Sciences,
June, 1923, No. 6, vol. clxv, p. 809

ACUTE PERFORATIONS OF STOMACH AND DUODENUM (WITH A REPORT OF SIXTY CASES).*

By Charles L. Gibson, M.D.
SURGEON TO THE NEW YORK HOSPITAL, NEW YORK.

A study of the results of operations for perforations of the stomach and duodenum shows very conclusively the value of prompt recognition and relief of this condition.

The 60 cases reported have been treated on the First Surgical Division of the New York Hospital from February 1, 1913 to April 30, 1922. The operators have been Drs. Gibson, Lee, Hitzrot and Farr. Fourteen of these cases were reported by me[1] in a paper published in 1916, and some of these cases were also reported in a paper by Dr. Farr[2] 1920.

The opinions expressed represent my personal views based on my experience since 1907 when I did my first operation for this condition.

The results obtained in this series confirm my previous belief of the desirability of aiming simply to close the perforation, leaving remote and problematical after results to be taken care of as necessity arises.

The mortality of the whole series, 16.6 per cent (Table I) is not high.

TABLE I.—MORTALITY RATE.

Cases.	Perforations.	Deaths.	Per cent.
43	12 hours	3	6.6 (2.3)
2	18 "		
5	24 "	1	20
10	Over 24 hours	6	60

It is particularly gratifying to note the small per cent, 6.6, in the first eighteen hours, only 3 out of 45 patients succumbing. In fact, the mortality really should be estimated as 2.3 per cent as 2 out of these 3 deaths occurred under conditions which would be

* Read before the meeting of the American Surgical Association in Washington, May 2, 1922.

[1] Surg., Gynec. and Obst., April, 1916, p. 388.

[2] Ann. Surg., November, 1920.

thrown out by many writers in reporting their results. The relative benignity when recognized and operated early becomes evident.

Case 210312, male, aged fifty-eight years, gave a gastric history of twenty years duration; perforation of ten hours; showed marked collapse with cyanosis and weak irregular pulse and subnormal temperature on admission; rallied under morphin and operated on under gas-oxygen. The night after operation the patient got out of bed, walked across the ward, drank a glass of cold water and collapsed. The temperature went to 105° F. and pulmonary edema developed. Death occurred a few hours later (autopsy).

Patient 220548 died forty-five days after operation, twenty-three days after an operation for empyema which could not be demonstrated to follow in any way the results of the first operation.

As will be pointed out later, I have never been in favor of performing a gastroenterostomy as a routine operation, although admitting its occasional necessity, and the low mortality of these early cases strengthens this belief and a study of the late results is also very satisfactory.

The particular points of interest in such a study will be to note: (1) Basis for early diagnosis. (2) Technical procedures, particularly in reference to the performance of gastroenterostomy. (3) After results and particularly bad results requiring further operative measures.

In regard to diagnosis we note in Table II, that the bulk of patients give a previous history of gastric disturbance, most of them of long standing.

TABLE II.—PREVIOUS GASTRIC DISTURBANCE.

	Gastric.	Duodenal.
No previous trouble	9	5
Trouble dating back less than a year	9	3
Trouble of long standing	9	21
Too ill to obtain a history	1	1
One previous attack five years ago, none since	0	1
Time indefinite, slight indigestion at times	0	1
	28	32

We note also that the onset is universally acute and that in all cases pain is given as the chief complaint, usually described as "knife-like." The symptoms in a typical case are unmistakable. Pain "in the pit of the stomach" comes on usually without premonition, is agonizing and often followed by considerable shock. Rather less than half of the patients vomit but vomiting has always been secondary to the pain. The vomitus rarely contains blood.

The patient becomes cold, sweats, and the facial expression reflects the great agony. Soon after these initial symptoms there comes probably quite often a symptom which is seldom described and seldom elicited because of its temporary duration and after it has disappeared the patient forgets about it as his attention is

concentrated on the persisting abdominal pain. I refer to severe pain coming on within a few minutes of the perforation and felt in the supraclavicular fossa, usually the left. It lasts only a few minutes, seldom more than fifteen. Given a clear history of this pain with a sudden onset I feel there is no symptom that is more characteristic.

The next most marked feature is a retraction of the abdomen, board like rigidity of the upper half, and great tenderness to pressure. At this stage there are practically no other symptoms worthy of consideration. Much time is wasted by some practitioners at this stage on three perfectly worthless diagnostic features (1) temperature, which may be low, may be normal, or may be slightly increased; (2) changes in the white cell count of the blood, total leukocytosis, percentage of polynuclears and their relation to each other. These changes will not take place until later; (3) obliteration of the liver dulness, a beautiful theoretical symptom which I have never been able to demonstrate in any perforation of the gastro-intestinal tract from any cause and never expect to.

With the progress of the condition we have a sequence of symptoms which are those of a peritonitis. If a patient is seen twenty-four hours after the perforation and a clear history has not been obtained of the previous condition and of the initial symptoms, attention is frequently centered on the possibility of a peritonitis from a perforation of the appendix, and this possibility is emphasized by the mechanical gravitation of the exudate from the upper part of the abdomen down the right gutter, giving tenderness most intense over the right lower quadrant.

The above classical picture is not infrequently modified, symptoms being milder and the onset less clear cut. The alteration of symptoms probably depends a good deal on the physical conditions, being less in a minute perforation with a minimum of extravasation of gastric contents. Moreover, some of these minute perforations become plugged by omentum, greatly modifying the course of the condition.

The conditions which may simulate an acute perforation of the late type are those of an intra-abdominal lesion which would call for interference, particularly appendicitis, acute cholecystitis, acute pancreatitis, and acute bleeding of a gastro-duodenal ulcer. It must also be remembered that occasionally two acute abdominal conditions occur simultaneously. All the conditions just described would justify opening the abdomen even on a mistaken diagnosis as a chance is given to remedy an acute and often dangerous condition.

The most serious mistake and one which I have once personally committed is operating in the face of an impending pneumonia as the signs are often quite identical, the pulmonary physical signs being delayed in their onset and the history misleading. A sign

which I have never seen described and have only lately thought of trying is auscultation over the pyloric region with the possibility of recognizing the to and fro passage of air from the stomach into the peritoneal cavity.

Diagnosis of the Condition When the Abdomen is Opened. When operating for a possible perforation or for any acute abdominal lesion that is obscure, I recommend the employment of a procedure which has been of great value to me for many years, namely opening the peritoneum under water. An incision is made down to the peritoneum which is seized between two clamps; the abdominal wound is flooded with water and peritoneum opened. Even the escape of a single bubble of air shows necessarily that there must be a communication with the gastro-intestinal tract.

On the other hand, there may be little or no air in the cavity and the perforation may be temporarily sealed off.

If there is any appreciable amount of fluid in the peritoneal cavity one is usually impressed with the oily or vaseline like character, sour smell, or possibly recognition of food particles, bile or other stomach contents. The administration of a teaspoonful of weak methylene blue solution by mouth just prior to giving the anesthetic is also of value as the stomach contents are easily stained by it.

Anesthesia. Anesthesia is that of the surgeon's choice. Personally I favor open ether, drop method, over all other forms.

Incision. The lesion being in the great majority of cases juxta pyloric, the incision is placed in the upper epigastrium to the right of midline. This should be a large incision, allowing of easy access to the perforation.

Operative Procedure. The perforation having been located usually with the greatest ease, the first thing in order is to close it. This statement may seem unnecessary but I have seen a lot of time wasted in sponging out the abdomen and puttering around while the hole is still discharging gastro-intestinal contents. Some operators report difficulty in closing these perforations; but so far I have been able always to close them securely, usually with mattress sutures or purse-string sutures of catgut. I occasionally feel more secure by fixing the sutured surface with some structure such as omentum or gall-bladder.

While these procedures have been under way, the assistant should have evacuated the abdomen of the extravasated contents. My own feeling is that with rare exceptions, and perhaps only in the later cases, is a drain necessary or even useful.

Cultures. A culture should always be taken and it will be surprising how often an extensive and muddy looking exudate will fail to show a growth.

Dr. E. G. Alexander, of Philadelphia, tells me that he has never obtained a growth within the first eighteen hours.

Closure of Wound. Closure of the wound should be done with much care and accuracy as these wounds do not heal very well and show a tendency to break open.

After-care. I think it extremely important to feed the patient at an early date and push nourishment rather more freely than is the custom.

Gastroenterostomy. In 1916[3] I gave in detail my reasons for not advising the performance of gastroenterostomy as a routine measure. I have had no reason to change my views and the results of the cases here reported, both immediate and remote, justify the belief. Of the 4 gastroenterostomies performed in this series a satisfactory suture was not or could not be made in three of them.

Briefly stated my arguments against routine gastroenterostomy are:

1. It prolongs and complicates what is usually a simple, quick and safe operation.

2. It is only very rarely needed as a technical adjuvant to correct or forestall a stenosis.

3. Few patients have any further trouble with their stomachs after recovery from acute perforation. Moreover, a gastroenterostomy is not a cure all or sure preventative for ulcers, acute or chronic.

4. Gastroenterostomy is an operation which has a certain proportion of recognized drawbacks and dangers.

5. What seems to me the most serious objection is the authority and teaching of particularly successful operators in influencing the unskilled or inexperienced surgeon to do more than he should normally try to accomplish.

End-results. At time of discharge all patients were free of symptoms with the exception of 2 cases that had a little distress after eating; but three months later were entirely well. All patients were reëxamined or reports obtained at variable periods and always three months after operation.* So far the results have been as follows:

Entirely free from symptoms, excellent result	37
Recurrence of symptoms	8
No data	4

Reoperation. We were obliged to reoperate in 16 per cent of our patients. The details are given as they present much of interest.

[3] Loc. cit.

* Our thanks are due to Dr. Arthur L. Holland, Associate Physician of the New York Hospital for his energy and devotion in investigating the condition of our patients showing poor end-results, particularly by making very accurate fluoroscopic examinations and for his wise counsel in directing the most important after-treatment in all cases.

1. Case 215651. Patient well for eight months. Symptoms then returned. Lost twenty pounds. At operation (two years after first operation), tight constriction of the pylorus found. Moderate amount of thickening on each side but no definite induration or ulcer. Posterior gastroenterostomy. Four months later in excellent health. Gained twenty-three pounds.

2. Case 216941. Patient free from symptoms for two years. At operation (two years and one month after first operation) marked duodenal ulcer on superior-posterior surface of duodenum, size of thumb. Pylorus moderately stenosed. Duodenum dilated. Cause adherent gall-bladder. Polya-Mayo resection of pylorus. One year later in excellent health and gained a great deal of weight.

3. Case 202624. Patient perfectly well for five and a half years. Came in for operation three weeks after onset of symptoms. At operation ulcer of duodenum well away from the pylorus, size second phalanx of thumb, very hard and irregular. Wound broke open on second postoperative day. Resutured, but on the twelfth postoperative day again broke open. Did not do well at any time. Vomited and ran constant temperature. Looked the picture of acidosis although urine was negative. Death resulted on twenty-seventh postoperative day.

4. Case 221456. Patient not well since discharge from hospital. Complaints, epigastric pain, loss of appetite, constipation. At operation four months later diffuse adhesions to omentum. Tight stenosis of pylorus due to cicatrization of old ulcer. Posterior no loop gastroenterostomy. Five months later much improved.

5. Case 215114. Return of symptoms one year after operation. Patient came in for operation three months after onset of symptoms. At operation diffuse adhesions, particularly of gall-bladder to duodenum, and of distal section of stomach to abdominal wall. All these were separated. First part of duodenum seat of hard callous ulcer, causing marked stenosis. Posterior no loop gastroenterostomy. Roentgen-ray diagnosis of pulmonary tuberculosis. Never proven from sputum. Died a year after discharge, apparently from pulmonary tuberculosis.

6. Case 229779. Patient readmitted eleven months after first operation. Duodenum is the site of an apparently healed perforation imbedded in solid mass of scar tissue and producing considerable stenosis. On account of technical difficulties thought wisest to do only a gastroenterostomy. Five months after discharge patient in good health and gained weight.

7. Case 232506. Patient readmitted six months after first operation. Numerous adhesions, particularly of gall-bladder to stomach. Stomach is folded over on itself by large adhesion. Ulcer $\frac{3}{4}$ x $\frac{3}{8}$ inch situated on posterior-superior wall. Pylorus turned away from duodenum. In view of mildness of symptoms referable to ulcer decided to do a gastroenterostomy. Five months later

condition somewhat improved although still has pain and has been told he has another ulcer. Has been living on a very limited diet. Gained a little weight.

8. Case 207098. Gastric history of long standing. Perforation four and a half years ago—suture. Patient free from symptoms until six weeks prior to present admission. Then had attack of epigastric pain. Suturing of perforation, two hours old. Perforation occurred in exactly same location as former one, to the duodenal side of the pyloric vein on the anterior aspect. Two years later in excellent health.

Two facts may be noted; that we have a large proportion of saved cases as possible candidates for trouble and if we had performed an "optional' gastroenterostomy on all our patients it is quite probable that 16 per cent or more would have reported more or less serious gastric disturbances.

Two of these cases requiring operation were originally long delayed cases and might have succumbed to a prolonged operation if a gastroenterostomy had been performed.

The conditions found in the 8 reoperated patients were:

5—Stenosis of pylorus.
1—Stenosis of duodenum by cholecystitis.
1—Adhesions.
1—Reperforation.

This gives a 10 per cent sequence of stenosis of pylorus.

Of the cases requiring reoperation the ulcers, with one exception, were situated in the duodenum. Of the results after operation 5 are good, 1 patient is having mild but rather persistent symptoms, 1 patient died and 1 patient died a year later of pulmonary tuberculosis.

The operations performed were gastroenterostomy (5); Polya-Mayo resection (2); suture of acute perforation (1).

We have operated on every patient in whom a possible diagnosis of acute perforation could be entertained. We had 1 case of perforated gastric ulcer revealed at autopsy. The patient was brought in in moribund condition, unconscious, without any history and died one and a half hours after admission.

Additional Data. 1. Location of ulcer.

Gastric, 28; deaths, 6 (1 ten hours; 5 over eighteen hours) 21 per cent.
Duodenal, 32; deaths, 4 (2 ten hours; 2 forty-eight hours) 12 per cent.

2. Sex:

Male, 56.
Female, 4 (3 gastric).

3. Age:

No patient under twenty.
Greatest number between thirty and forty.

4. Operation:
   Suture of perforation, 56 cases, 9 deaths.
   Suture of perforation and gastroenterostomy, 2 cases, no deaths.
   Two gastroenterostomies, 1 without suture, 1 by plugging hole with omentum. Case without suture died.
5. Drainage:
   Cholecystectomy cases, 3.
   Gastroenterostomy, 3.
   Perforation twenty-four hours or over, 6.
   Perforation under twelve hours, 4.

Summary. For the sake of simplicity and because practically all of these ulcers were juxta pyloric, we have considered them as a single entity. A few facts may be emphasized:

1. That the duodenal ulcers, contrary to probability, give severer symptoms and a longer history. Of the patients giving a history of long standing gastric disturbance 30 per cent were gastric, 70 per cent duodenal. Of the patients giving a history of no previous trouble 65 per cent were gastric, 35 per cent duodenal.

2. The mortality from acute gastric perforation is almost double that of duodenal, namely 21 per cent to 12 per cent.

3. Duodenal ulcers give a maximum of conditions requiring further operation, 7 out of the 8 reoperated cases being duodenal. Of the 5 cases of pyloric stenosis found at reoperation, 4 were duodenal.*

* October 15, 1922; 4 more cases of acute perforations have been successfully operated, 2 duodenal, 2 gastric, all within the twelve-hour period.

THE SUSPENSION TRACTION TREATMENT OF FRACTURES OF THE LONG BONES NEAR LARGE JOINTS*

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NEW YORK

The underlying principles which make for efficiency in the suspension traction treatment of fractures of the long bones are now well understood. Foremost among them is that this form of treatment takes into full consideration the necessity of caring for the damaged soft parts. Full recognition is given to the truth that in many instances muscular, fascial and joint repair are far more important in restoring a properly functioning limb than absolute anatomic restitution of the bone. This form of treatment also accepts the truth of the teaching of Lucas-Championnier, that complete fixation of fragments is not necessary for proper callous formation, in fact, may be detrimental to it.

In addition to these, the traction suspension treatment affords the best means of placing the distal fragment in proper alinement with the proximal fragment. In every fracture of a long bone, two elements enter into the resulting deformity. Either a proximal fragment is drawn from the planes of anatomic rest, while the distal fragment assumes such position, or the distal fragment is drawn out of the planes of the normally placed proximal fragment. Not infrequently, these two elements are combined. As a rule, the first effect is more marked when the fracture line lies near the proximal end of the bone, while the second is more prominent when the fracture line lies near the distal end. Almost universally, the surgeon has better control over the distal than the proximal fragment. Therefore, treatment aims so to place the traction suspension forces that the former is drawn into proper alinement with the latter. Occasionally, it is helpful to supplement this with traction applied to the distal end of the proximal fragment. Our means for doing this are, as yet, not over adequate; but I am inclined to believe the method of Heitz-Boyer can be made to find a wider application than it has enjoyed.

It is my belief, that with proper attention, practically every fracture through the middle third of a long bone can be successfully treated by the traction suspension method, and that the results will be more promptly obtained and better functionally than by other methods. In other words, I have found the principles of this method sound and

* Read before the American Surgical Association, Toronto, June 14, 1921

their application possible with this type of fracture. It must be emphasized, however, that the application is often beset with difficulties, and that patient, untiring effort will alone be rewarded with success. It is a method that can be applied only after considerable experience, and with attention to detail that many surgeons are unwilling to give. Its success, therefore, depends on the opportunity to see and treat a considerable number of cases, coupled with a recognition of the fact that the expenditure of time and care will bring a satisfying reward. The hospital service—Cornell Division of Bellevue Hospital—where our study has been carried on, furnishes in abundance the former, and has been fortunate in having on its staff two men (Dr. Kenneth Bulkley and Dr. James Worcester) who have furnished the latter, and by their enthusiasm, inculcated their confrères with the desire to continue the work.

Fig. 1.—Dr. Worcester's modification of tongs, with blunt conical points to prevent too deep penetration.

As a result of our experience, I repeat that only very exceptionally do we encounter a fracture in the middle third of a long bone which cannot be successfully treated by the traction method. Every fracture is made an emergency case in that its treatment is immediately undertaken on admission. A preliminary roentgenogram is taken. The method of applying traction in fractures of the femur is by means of the ice tongs, as modified by Dr. Worcester (Fig. 1), and suspension is obtained by the Thomas splint and the Balkan frame (Fig. 3). In an adult male, the initial weight applied is 25 pounds or more. This is reduced when the roentgenogram indicates that it is possible. It cannot be overemphasized that the immediate application of sufficient weight to overcome the shortening is all important. Over pull is preferable to under pull. Too little weight at first results in a fixation

of the injured muscles in a shortened condition, and necessitates later a far greater weight than would have been initially needed. The suspension is done in the recognized way, so that active and passive motion (by means of pulleys) of both the hip and knee are at once begun. In humeral fractures, the traction is obtained either by adhesion to the skin or by means of the Henniquen band around the flexed elbow. From 5 to 8 pounds is sufficient, and either method will support this without difficulty. The suspension is by means of a specially constructed addition to the Balkan frame, which permits traction at any angle with the trunk (Fig. 4). Fractures in the shaft of the leg are usually drawn into direct alinement without difficulty. Occasionally, however, badly comminuted fractures show a persistent deformity which can

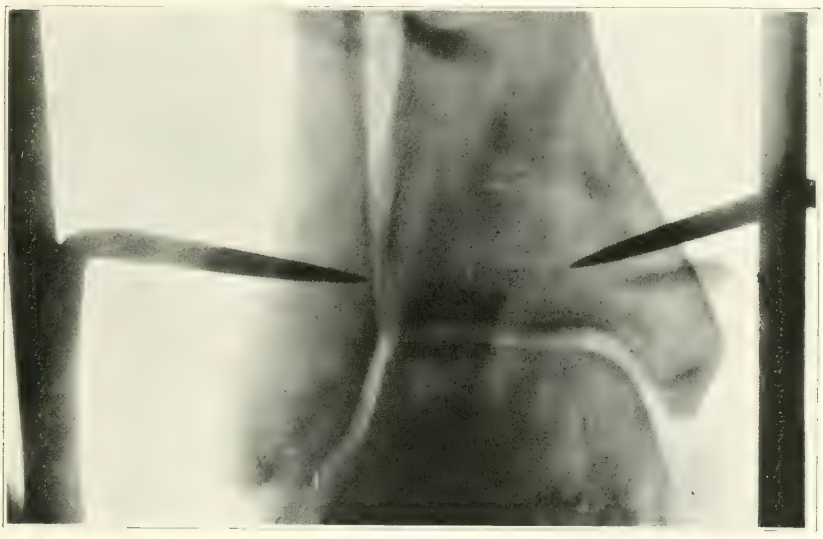

Fig. 2.—Tong points too tapering. They penetrate too deeply.

be readily overcome by tong traction on the malleoli or os calcis, or by the Henniquen band if low, or skin traction if high. Our success with the Sinclair skate has not been satisfying.

What has been stated concerning our satisfaction in this method of treating fractures through the middle third of the long bones, cannot be said with the same degree of satisfaction concerning fractures near the large joints. However, our experience here leads us to believe that further study will overcome the difficulties we have encountered, and we are satisfied that in the end such fractures will yield a higher percentage of good results by this method than by any other.

It must emphasized that a perfect anatomic repair of a bone, accompanied by a badly crippled joint, is far more disturbing to the

patient than a poor position of the fragments with a well functioning neighboring joint. In many cases a proper reposition of the fragments has in my hands proved impossible. Nature, however, has responded more than satisfactorily in her ability to reestablish a range of motion in the joint which permits of all essential activities.

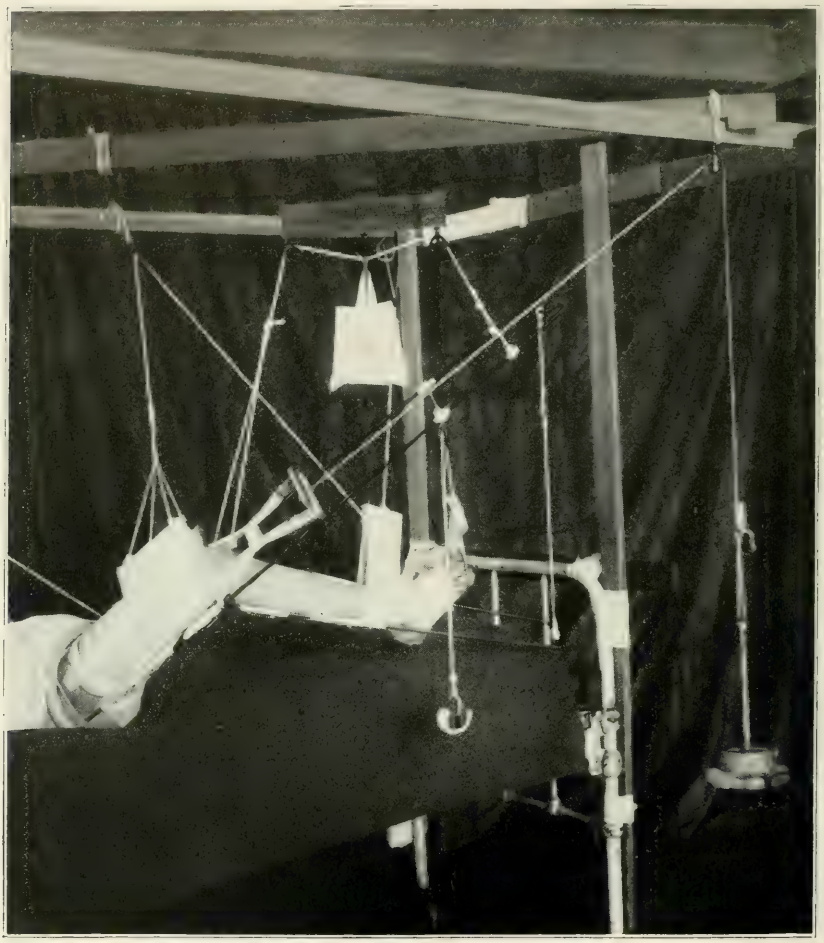

Fig. 3.—Suspension in Balkan frame for a high fracture of the femur with skin traction, illustrating outward rotation, abduction and leg flexion splint attached to the Thomas splint. When only moderate traction is needed, it can be obtained by skin adhesion on the thigh, still allowing knee movements.

Fractures near the hip, the knee, and the shoulder have received the most attention.

When the femur is fractured somewhat below the tuberosities, the upper fragment usually assumes a more or less constant position of

external rotation, and abduction, by reason of the stronger group attached at the greater tuberosity, and of flexion because of the direct pull on the lesser trochanter. The extent of these forces varies greatly according as the fracture is near or removed from the line of the tuberosities. If placed some inches distant, so that some fibers of the

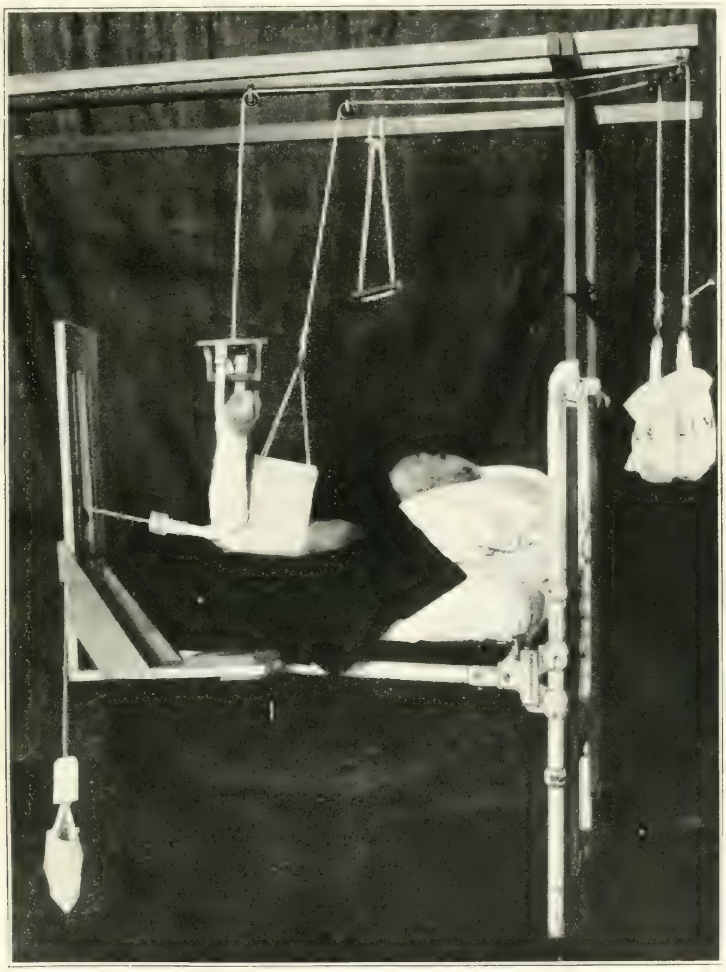

Fig. 4.—Traction of arm in only slight abduction. The amount of abduction is modified as needed by means of the hinge between the mattress board and the horizontal board. The elbow is lowered or raised by the movable pulley attachment within the slot on the vertical support.

abduction group remain attached to the upper fragment, this portion of the femur may be drawn into abduction, and neither external nor internal rotation is present. Moreover, in some instances, the fracturing

violence may cause unusual positions of the fragments, at the time of injury. The fractured ends having penetrated deeply into the muscle and fascial structures are prevented from taking up the positions

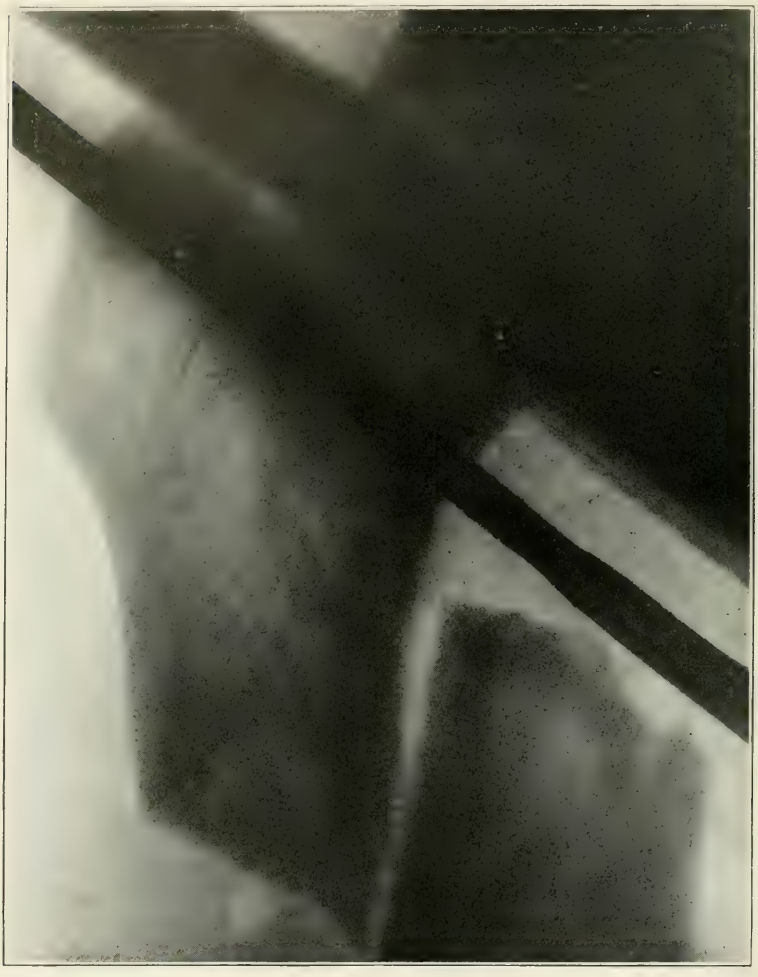

Fig. 5.—Subtrochanteric fracture without either abduction or external rotation of the upper fragment. This fragment is held in slight adduction by the pull on the adductors exerted by the lower fragment being drawn well upward and inward. The fracture was caused by violence applied directly to the external aspect of the femur at the point of fracture, with sufficient force to displace it well inward.

resulting from the abnormal muscle pull alone. We have thus come to learn that one may not rely on a knowledge of muscular action only to predicate the position of the fragments even in such classical

fractures as subtrochanteric or those through the surgical neck of the humerus. Dependence must, in the last analysis, be placed on the roentgen ray, and, therefore, the treatment of fractures can be carried out properly only when a bedside apparatus is continuously available.

Fig. 6.—Same fracture as in Figure 5, twenty-four hours after applying tong traction of 25 pounds. The overriding is corrected; but the upper fragment is still adducted.

These points are all well illustrated in the case of a woman, aged 60, who, in a street fight, was knocked down and jumped on by another woman (Fig. 5). The violence was applied mainly to the upper right thigh. Admission to the hospital was three days after the injury. There was an obvious fracture about 3 inches below the trochanters,

with overriding of 2 inches. The upper end of the lower fragment was displaced inward and slightly anteriorly as might be expected. The upper fragment, however, was also adducted, and in normal rotation. A study of the condition, both by palpation and the roentgen

Fig. 7.—Same fracture as in Figures 5 and 6, showing better alinement which was obtained by placing the limb in adduction, with lateral counter pull by a sling placed around the upper end of the lower fragment.

ray, showed that the upper fragment was held in this position because of the pull of the torn adductor muscles, which were tightly stretched over the lower fragment. The latter, by the direct violence of the injury, had been forced inward and dragged the upper fragment with it.

An attempt to place such a fracture into proper alinement, by abduction of the limb with traction suspension, failed. A satisfactory position was obtained only by tong traction of 25 pounds applied above the condyles, with the limb suspended in adduction and some flexion.

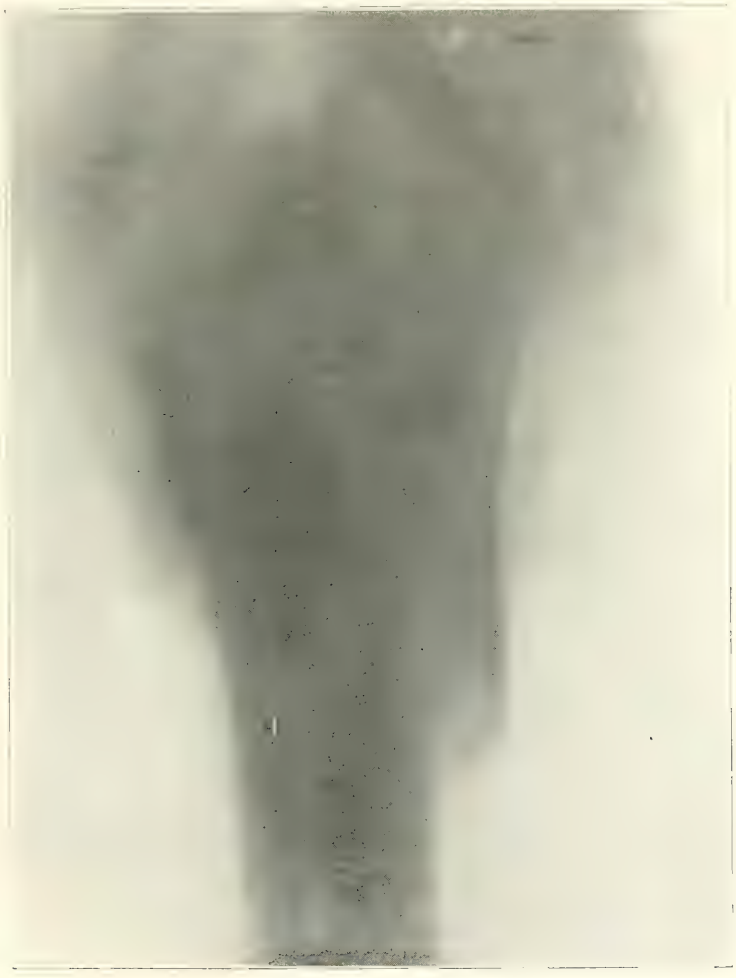

Fig. 8.—High spiral fracture of femur together with fracture through the lesser trochanter; upper fragment rotated outward and abducted; satisfactory result obtained by the treatment shown in Figure 2. In such cases only moderate traction is needed.

Even though there was a delay of a week from the time of injury before this was done, the overriding was entirely reduced in forty-eight hours (Fig. 6), whereas five days of skin traction had completely failed.

After correction of the shortening, there was still inward displacement of the upper end of the lower fragment which could be corrected only by direct outward pull by means of sling and pulleys.

The functional result in this patient was most satisfactory. Movement at all joints was practically normal; union was firm, and the anatomic deformity in the bone could be known only by means of the roentgen ray. In consideration of her age, 60 years, her alcoholic habit, and the presence of Paget's disease, she continued to use an ambulatory splint for eight months.

It was this case which first emphasized the necessity of recognizing that dependence cannot be placed on muscle pull alone

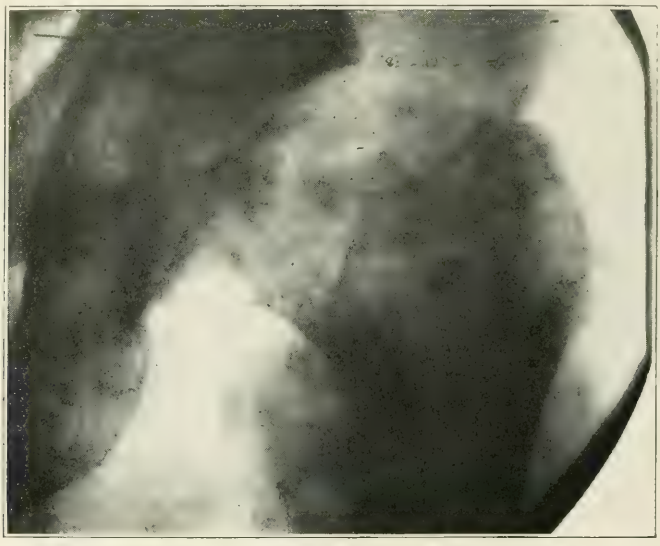

Fig. 9.—Pertrochanteric fracture.

in determining the position of the fragments. Several days were wasted in an attempt to place the lower fragment in line with an upper fragment erroneously presupposed to be abducted.

A contrast to this case is shown in Figure 8. The fracture is higher, the lesser trochanter being attached to the lower fragment, and the line of fracture is spiral. The upper fragment is in marked abduction and outward rotation, the classical deformity. Suspension, tong traction of 25 pounds immediately after receipt of injury, reduced to 15 pounds after only twenty-four hours, and replaced by skin traction after four weeks, was the treatment used. The limb was placed in 45 degrees abduction, moderate flexion, and extreme external rotation. The knee was flexed to 45 degrees on a movable leg attachment to the Thomas

splint. There was complete union, with full motion at all joints, at the end of two months. The patient was up in a chair for a month longer and then discharged wearing a Thomas caliper splint. He has failed to report at the follow up clinic; but there can be no doubt of an excellent result as judged by the condition on discharge.

Fig. 10.—Dr. Rogers' attachment to wheel chair for carrying out all the requisites of traction suspension treatment. This should be used only when union is nearly complete and when only moderate traction is needed.

Our experience with the suspension traction treatment of fractures in immediate relation to the hip joint, either through the trochanter or of the neck proper, has not been extensive. It is sufficient, however,

to convince us that excellent results may be obtained with the former, and we can find no reason to believe that the latter also will not respond favorably.

A pertrochanteric fracture, involving the distal end of the neck, was received by a man, aged 36, when he fell down-stairs. He was immediately admitted to the hospital with the typical disability and deformity of this condition (Fig. 9). Treatment was by suspension in

Fig. 11.—Fracture through neck of femur, showing functional result after three months' treatment in traction suspension, with 15 pounds skin traction.

flexion, outward rotation, and 45 degrees abduction. The knee was placed in 45 degrees flexion on a movable leg attachment to the Thomas splint. Skin traction was used to the amount of 15 pounds for six weeks, and then reduced to 10 pounds. The patient was allowed to be up in a wheel chair with a Thomas splint attachment for suspension and traction (Fig. 10), devised by the resident surgeon, Dr. William

A. Rogers, for ten weeks longer. He was then discharged wearing the caliper splint. He reported six months after receipt of the injury, when the following condition was noted: "The patient walks normally. No limp. Has no pain in hip, but states that the knee becomes stiff when he doesn't use it. After walking a little, it is all right. The caliper brace was removed five and a half months after receipt of the

Fig. 12.—Fracture through neck of femur, showing functional result after three months' treatment in traction suspension, with 15 pounds skin traction.

injury." Complete restoration to a normal working condition, therefore, was present in this case in less than six months. The absence of muscular atrophy and joint disability is a noteworthy concomitant of this form of treatment as compared to its prevalence in complete fixation with plaster cast.

As stated, our experience in similar cases is limited; but there have been no failures, and the consensus of opinion of the staff is that the results are far more satisfactory than with fixation methods, and that the patients are, on the whole, far more comfortable.

A typical fracture of the neck of the femur is shown in Figure 11, and the outcome at the end of three months is shown in Figure 12.

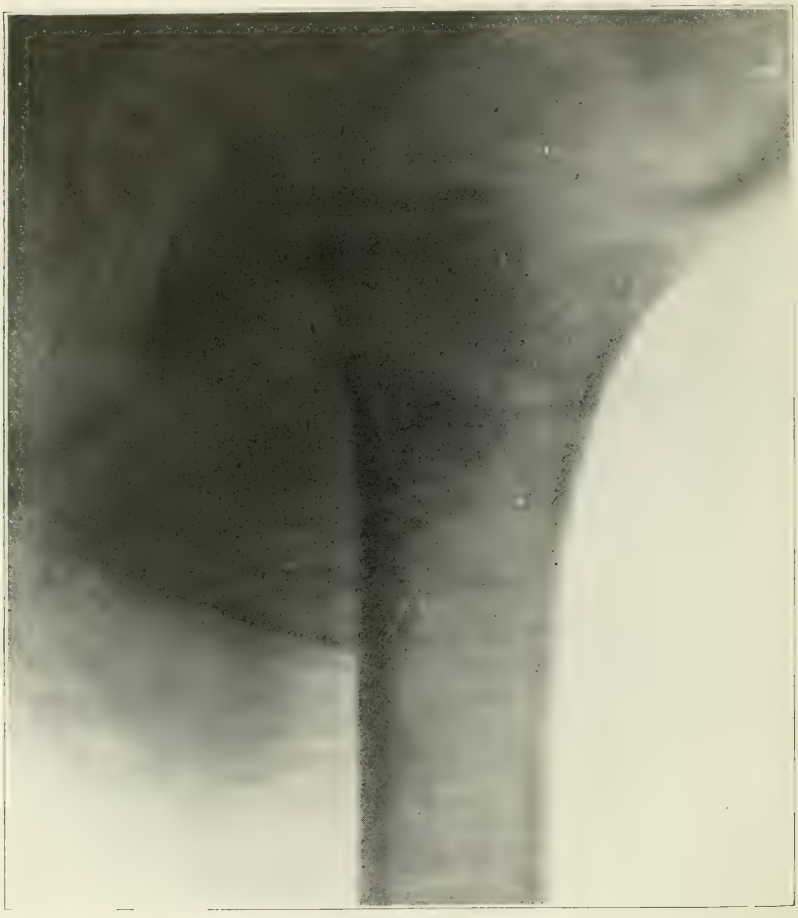

Fig. 13.—Fracture of surgical neck of humerus, with the greater tuberosity completely avulsed. The upper fragment is turned so that the fracture line looks almost inward. This is hardly possible if the tuberosity remains attached to the proximal fragment. This patient was operated on with fair success.

This fracture was treated throughout with suspension traction in marked abduction and external rotation. Skin adhesion was used, and movements in the hip and knee were carried out from the first. The

result, after six months, was an entirely normal hip so far as weight bearing and range of motion were concerned. The roentgenogram showed a moderate coxa vara.

Fig. 14.—Extreme abduction and external rotation needed to procure proper alinement when a surgical neck fracture allows this exaggerated position of the proximal fragment by pull on the greater tuberosity.

Fractures in and about the shoulder joint show many similarities to those occurring in the upper end of the femur. The essential difference, however, in obtaining a satisfactory functional result is that the

range of movement in the shoulder is all important, while weight bearing without shortening is the prime consideration at the hip. For this reason, treatment of high fractures of the humerus must aim to procure union with the fragments so placed that joint obstruction will not take place and that muscular action may be efficient.

The usual deformity which results from a fracture through the surgical neck of the humerus is abduction and external rotation of the upper fragment. There are many exceptions, however, due to various causes. The most common is a coincident tearing off of the greater

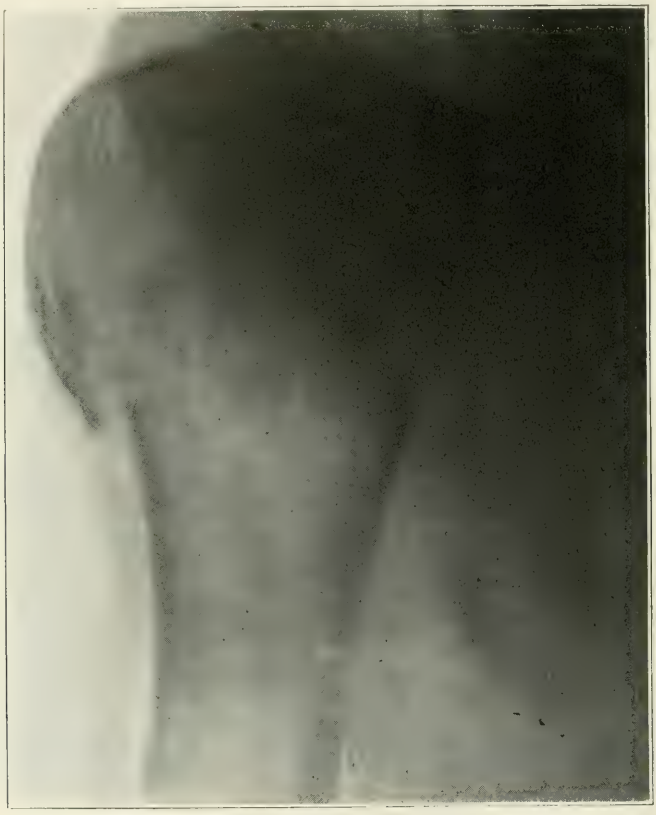

Fig. 15.—Upper fragment in surgical neck fracture is not abducted or rotated, because, as we believe, the muscular attachments are torn away without actual separation of the tuberosity. This fracture was at first treated in slight abduction and later full abduction and external rotation (Figures 4 and 14 are examples) with excellent result and full restoration of function.

tuberosity. This leaves the upper fragment uninfluenced by the muscles attached to this prominence, and it may assume any position, even to an amount of rotation inward so that the fractured surface faces

the glenoid fossa. Such a complete reversal results in leaving the upper fragment beyond control, and so far as we have determined, nothing can be accomplished by traction suspension in changing its position (Fig. 13). Open operation seems a necessity. On occasion, however, the inward displacement is not so complete, and then by placing the humeral shaft in the proper amount of abduction, the fragments are

Fig. 16.—Variations in position in fracture of surgical neck with tearing away of muscles from greater tuberosity.

well alined. After from ten days to two weeks, there is sufficient union to cause the upper fragment to follow the arm as the abduction is increased from day to day. Finally, there is a hyperabduction and external rotation, which then brings the upper fragment in contact

Fig. 17.—Variations in position in fracture of surgical neck with tearing away of muscles from greater tuberosity.

Fig. 18.—High spiral and comminuted fracture of the humerus, in abduction after partial union is established. The proximal fragment was drawn inward by pectoral major fibers.

with the abducted and externally rotated greater tuberosity. Union then results. On recovery the arm falls by gravity to adduction and internal rotation, by which the abduction and external rotation group are drawn out to their normal length, and hence can again function. It is important that some movement should be made in the arm constantly. The

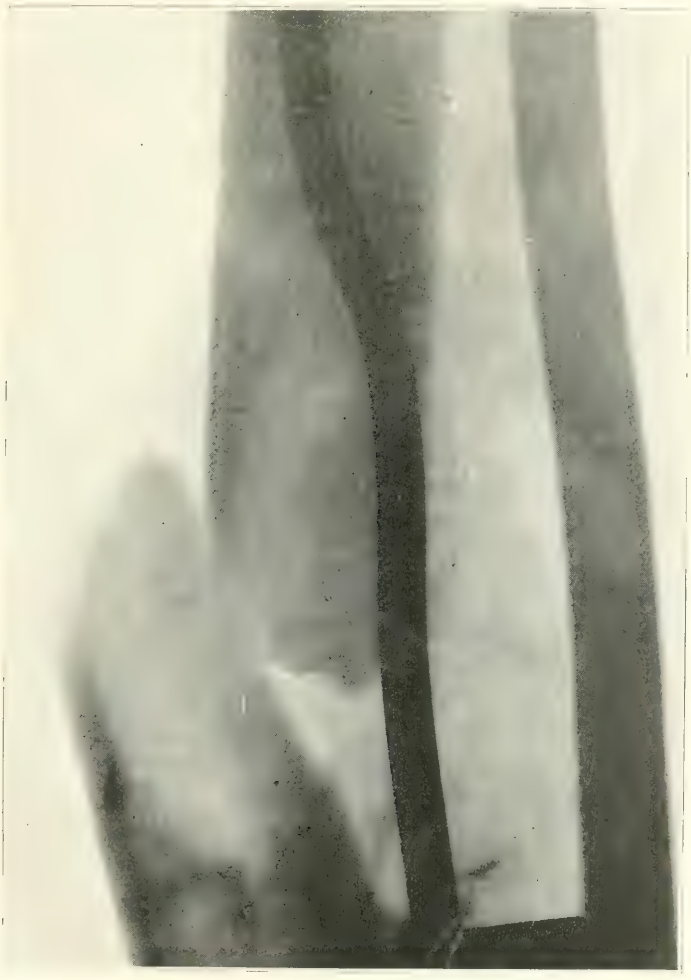

Fig. 19.—Fracture near knee joint, with the lower fragment forward. Flexion of knee exaggerated this deformity while extension corrected it. This and Figure 20 represent the same angle and amount of traction (25 pounds) by tong attachment.

traction suspension treatment ideally furnishes an opportunity for this. Ten pounds is usually sufficient, applied by means of skin traction. The needed modifications in position are obtained by means of the support (Fig. 4) and direct traction (Fig. 14).

One must further recognize that inward rotation of the upper fragment may take place when the muscles or the periosteum are torn from the greater tuberosity without actual separation of the tuberosity itself. This injury need not show in the roentgenogram, though in some cases the periosteal stripping can be seen (Fig. 15). The impor-

Fig. 20.—Fracture near knee joint, representing the same angle and amount of traction (25 pounds) by tong attachment as Figure 19.

tance of this is found in the fact that unless the inward rotation is recognized, the arm may be easily placed in too great abduction. We have fallen into this error on one or two occasions.

Here again, when the fragments are sufficiently adhered, it is necessary to increase the abduction from day to day, so that the greater

tuberosity may be brought into contact with its separated and contracted muscular insertions.

Finally, the fracture of the surgical neck may run obliquely down the shaft so that portions of the pectoral major are attached to the upper fragment. This condition, with entanglement of the fragment

Fig. 21.—Late result: some deformity, but fair movement in the knee joint.

ends in this muscle and the deltoid or arm muscles, may produce bizarre positions.

The important consideration, therefore, is to obtain accurate information as to the position of the upper fragment, by means of the roentgen ray—no other examination will give this—and place the distal fragment by traction suspension in proper alinement with it. Ultimately,

however, the extremity must be brought into complete abduction—sometimes hyperabduction—and external rotation. During healing, a certain amount of active motion must be carried out, this being facilitated by proper counterpoising, so that the entire weight of the limb does not fall on the muscular pull.

Fig. 22.—Late result: some deformity, but fair movement in the knee joint.

The service has afforded many examples of these fractures, all of which have been treated along the lines here described. The functional results have been, without exception, excellent.

This form of treatment, of course, requires confinement to bed for a period of about four weeks. This is not too great a price to pay

for the obtaining of a thoroughly useful shoulder. Examples of these fractures are given in Figures 11 to 18, and the methods of obtaining the needed positions are illustrated in Figures 4 and 14.

Fractures of the femur near and involving the condyles present peculiar difficulties. The typical supracondylar fracture, with the lower

Fig. 23.—Fracture treated by suspension and traction by tongs in the os calcis, with excellent result.

fragment drawn directly backward, can easily be drawn into proper alinement by placing the tongs sufficiently far back and high enough to draw this fragment forward. This is accomplished by so arranging the supporting pulley that the line of traction is 45 degrees or more upward. The fulcrum then comes at the line of the condylar surface

against the patella and its ligament. This is made more efficient by flexion of the leg, and in the first days movements in this joint may be only minimal. After some days, however, the alinement can be maintained even when the leg is moved through a considerable arc. When, however, as illustrated in Figure 19, the lower fragment, by the fracturing force, is driven forward, while the upper fragment lags behind,

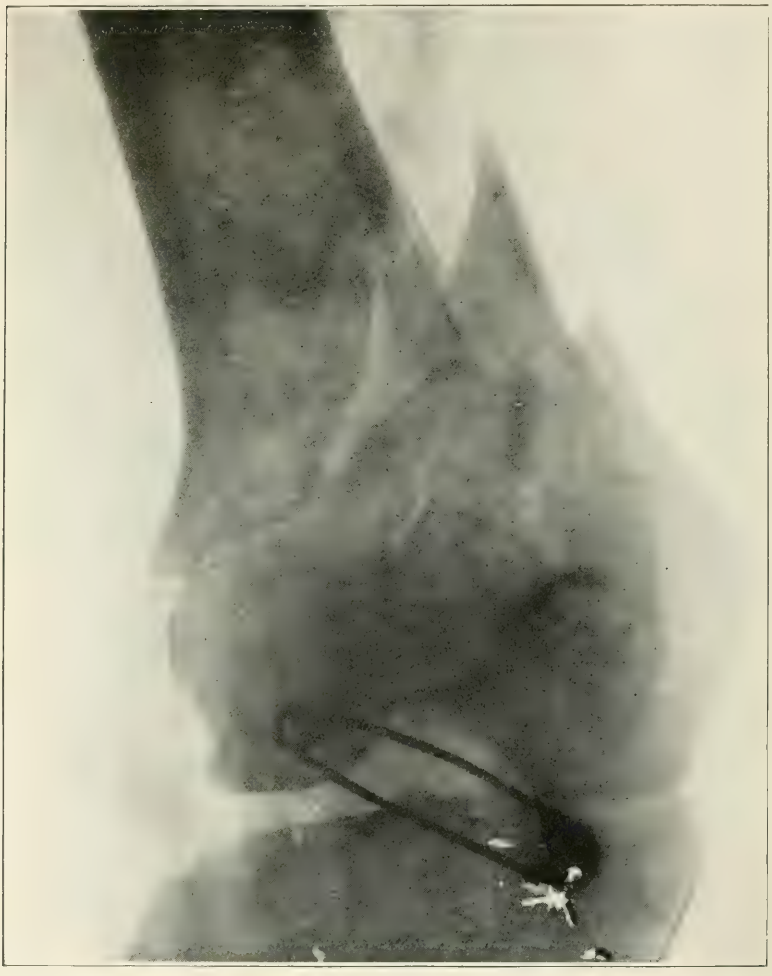

Fig. 24.—Comminuted fracture about femoral condyles, treated by suspension and traction on Steinmann pin through tibial head, for five weeks, with leg extended. Active motion on movable leg attachment then instituted.

we have been able to get proper alinement only by keeping the leg in extension. To do this sacrifices one of the great advantages of the method of treatment, namely, active movement. One must, therefore,

determine in each case whether the wise course is to obtain good alinement without active motion in the knee, or accept some deformity with a good functioning knee joint. In the case above cited, a middle course was followed with a fairly satisfactory result (Figs. 21 and 22), though the fracture was compound, with almost complete rupture of the quadriceps at the site of fracture.

Fig. 25.—The result.

The badly comminuted and displaced fractures involving the femoral condyles and knee joint present unusual difficulties. As a rule only moderate traction is needed; but the problem of securing this, and, at the same time of permitting knee movement, must be solved. Figure 24 shows such a fracture in a woman, aged 60 years, received by a fall

Fig. 26.—The fracture ward, showing the number of cases on a general surgical service of ninety beds.

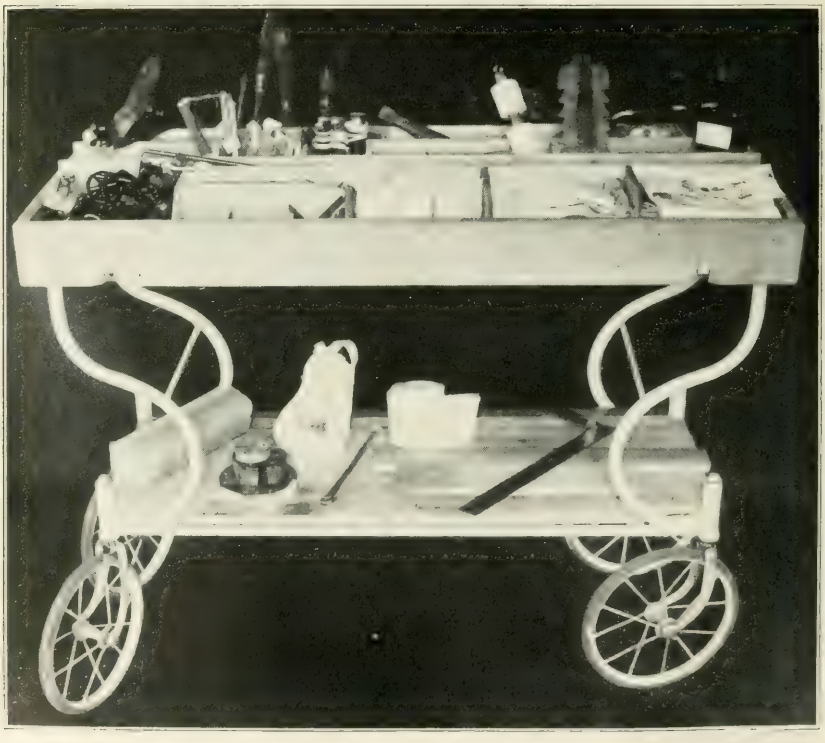

Fig. 27.—The fracture truck assembled by Dr. Bulkley. This carries everything needed in applying suspension traction and is a most essential unit in the equipment.

of 8 feet and landing on the foot with leg extended. The treatment was by means of traction on the Steinmann pin through the tibial head, and suspension at first with the leg extended. After five weeks the movable leg attachment was utilized, traction removed, and active movement at the knee instituted. The result is given in Figure 25, when the function of the knee was excellent and the patient could walk without pain or limping. Flexion beyond a right angle was present.

No other similar case has come under treatment, but the outcome here indicates that the suspension traction treatment can be used to advantage.

The traction suspension treatment has also been found efficient in badly comminuted or long spiral fractures of the tibia and fibula near the ankle joint. The tongs may be placed either in the malleoli or the os calcis. Figure 23 shows one case of this sort treated with an excellent result. Our experience has led to the conviction that this method of treatment is deserving of careful study on the part of those treating fractures. In a hospital where fractures are treated in any number, it should constitute the standard treatment. Its possibilities, I believe, are greater than the results here shown. It is not, however, a method easy of use, and only by rather long intensive study may one perfect himself in the technic.

The study on the Bellevue service has been carried on by the entire staff. I desire particularly to express my appreciation to my former associate surgeons Dr. Kenneth Bulkley and Dr. James Worcester, who successively have had charge of the fracture work, and to the resident surgeon, Dr. Russell Patterson, who has taken most of the roentgenograms and given valuable aid in the preparation of this communication.

Reprinted from the Archives of Surgery
November, 1921, Vol. III, pp. 595-621

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AMERICAN MEDICAL ASSOCIATION
FIVE HUNDRED AND THIRTY-FIVE NORTH DEARBORN STREET
CHICAGO

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
May, 1922.

ANOMALOUS ABDOMINAL MEMBRANES*

THEIR INFLUENCE UPON THE DIGESTIVE TRACT

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Because of the tediousness of an attempt at detailed discussion of the many complexities, anatomical, pathological, and symptomatic, associated with this subject, it has seemed best to present the general considerations for discussion at this time, reserving for more complete presentation, in later communications, the different groups involved. No attempt is made to follow the chronological history of the development of the subject, nor to present a complete bibliography, nor to claim any priority or originality in the matter.

This paper is based upon a series of personal cases operated upon since 1914, of which the first fifty are taken because sufficient time has elapsed to get an idea of end-results.

The membranes encountered in this series were in the following groups: (1) Hepato-duodenal and hepato-duodeno-colic. (2) Duodeno-jejunal. (3) Jackson's membrane, or pericolic membrane. Associated with this last were certain anomalies of the omentum in a small percentage of the cases, and a chronic appendicitis in many cases. Any one, any two, or the entire combination may appear in the individual patient. In a considerable number the appendix had already been removed without relief, so that post-operative adhesions were added to the pathological picture. Scattered irregularly through the series have been occasional complications such as ulcer, biliary calculi, cholecystitis, perihepatitis, pelvic disturbances, etc.

The hepato-duodenal, and its modification, the *hepato-duodeno-colic* membrane, runs from the cystic duct and a greater or less portion of the gall-bladder, down to the first portion of the duodenum, running from the apex toward, and often as far as, the pylorus. When there is a colic part to the membrane, it is usually a continuation downward from the duodenum and pylorus to the beginning of the transverse colon. This membrane is nearly always made up of two distinct leaves, just as is the mesentery of the intestine. Usually it is thin and transparent, just as is the peritoneum. There is seldom much vascularity in the membrane. In the majority of instances the membrane involves from one-third to one-half of the lower

* Read before the New York Surgical Society, January 25, 1922.

border of the gall-bladder. In a few cases it extends outward to the fundus and in at least two instances a double membrane extended from 1 to 2 cm. beyond the fundus, and was continuous with the peritoneal covering of the liver. In certain instances the membrane is very narrow and involves only the cystic duct. It extends to the first portion of the duodenum and often to the pylorus. Most of the illustrations, which have appeared in various articles on this subject, have shown these membranes going down to the duodenum, usually with the portion going from the cystic duct reaching the duodenum toward the pylorus, and the outer edge of the membrane running from the under surface of the gall-bladder to the apex of the duodenum. This gives a different picture from that which has been seen in this present series of cases, in which, in every instance where the membrane was sufficiently well developed, the portion running from the cystic duct went directly to the apex (the junction of the first and second portions of duodenum) of the duodenum, and then extended out upon the gall-bladder toward the fundus and down upon the first portion of duodenum toward the pylorus, so that the free edge extends from the under surface of the gall-bladder to the duodenum near or at the pylorus.

In a number of instances the pylorus and beginning duodenum have been directly in contact with the fundus of the gall-bladder, and the first portion of the duodenum has then run along the gall-bladder to the cystic duct. The membrane has then consisted of a fold running on each side directly from the gall-bladder to the duodenum with unperitonealized surfaces at least 1 cm. wide between the duodenum and gall-bladder.

In addition to these peritoneal membranes, there have, in a few instances, been entirely separate cicatricial adhesions running from the duodenum to the under surface of the liver, either just to the right or just to the left of the cystic duct. In certain cases, without there having been any anomalous membrane, the gastrohepatic omentum has been unusually short, and its free edge quite thickened and rigid has extended somewhat to the right so that the apex of the duodenum has been elevated, firmly fixed and angulated. In two cases (VI and XXII) the membrane was so situated about the cystic duct as to cause a constriction and a sharp angulation with symptoms of biliary colic which will be referred to later. In one case (of a later series) the duct was given a double angulation by the drag downward of this membrane. Extension of the membrane to the colon often causes high fixation with angulation or constriction, or both, and usually fastens the pylorus or the antrum and the transverse colon closely together so that the overfilling of either one interferes with the function of the other.

This membrane acts to interfere with the digestive function in several ways. The apex of the duodenum is practically always fixed at an unusually high level beneath the liver and is also dragged distinctly backward. It is usually rather firmly held in one position with only slight mobility. The membrane often reaches across the front of the duodenum in such a way as to cause compressions and kinking in addition to the high fixation. In

several cases where the membrane reached from the apex of the duodenum downward obliquely across the front of its first portion to the lower edge of the pylorus, there was added torsion, on its long axis, of the first portion of the duodenum. Further, in many cases, if the membrane runs well out upon the gall-bladder, it reaches the first portion of the duodenum after passing across the front of the descending duodenum so that in this way there is added a certain amount of compression of the descending duodenum.

In these cases where the stomach has gradually dilated in consequence of the continuous partial obstruction to its proper evacuation, the pyloric end of the stomach will be pushed over well to the right of the mid-line and then because of the fixed position of the first part of the duodenum it bends sharply backward, inward and upward. This adds kinking in the pyloric antrum which also adds to interference with gastric function. This angulation of the antrum has been repeatedly demonstrated upon the operating table. When the obstruction has continued long enough, the stomach becomes considerably dilated and we have the perfectly typical ptosed fish-hook type of stomach, in which the first portion of the duodenum will not infrequently be elongated because of the downward drag of the stomach on the fixed apex of the duodenum.

Anomalous membranes about the duodeno-jejunal angle are quite variable and can hardly be put into groups or classes. In some cases the ligament of Treitz is anomalous; it extends upward and to the left and pulls the angle far upward and outward—causes sharp compression from extending over its anterior surface, and causes sharp angulation because of its high elevation. This has several times been the cause of marked obstruction with resultant great dilation of the dependent duodenum.

In one instance the beginning jejunum curved from the "angle" in front and over to the right of the superior mesenteric vessels where a double fold of thin, transparent peritoneum ran upward and to the right, fusing with the inferior mesocolon, and then the jejunum ran sharply to the left again. This made a regular Z-shaped, double-kinked deformity resulting in serious interference with the function of the duodenum.

In a number of instances the peritoneum in front of the superior mesenteric vessels has been very considerably thickened and in two instances there have been small calcified lymph-glands in the same situation.

At this point one should at least mention certain other forms of duodenal obstruction, although they are not the result of these anomalous peritoneal membrane formations. These other types of obstruction have been well described by Kellogg and have to do with obstructions from the mesenteric vessels and certain kinkings and adhesions retroperitoneally. In one of the cases, following this series of fifty, there was distinct constriction of the descending duodenum by fibrous tissue in the transverse mesocolon where the duodenum passed behind it.

The result of these anomalous membrane formations, as well as other types of obstruction, is to cause marked dilation of the duodenum proximal

to the obstruction. There is, of course, great interference with the proper function of the duodenum with resulting symptomatology later to be mentioned.

Jackson's membrane, or *pericolic membrane,* is another of the very atypical, anomalous membranes. It would perhaps be better to call these membranes by the term pericolic, inasmuch as Doctor Jackson objects that many men are reporting cases under the title of "Jackson's Membrane" which are not truly such. The term, "Jackson's Membrane," has been used in the records of these cases to indicate membranous formation running from the outer side of the cæcum and ascending colon up to and across these portions of the gut. The most extensive membranes involve the cæcum and ascending colon up to and including the hepatic flexure. On the other hand, there may be present merely a small, narrow band of membrane located either at the hepatic flexure or, more commonly, about the middle of the ascending colon, or in relation to the beginning ascending colon just above the cæcum. Between these limits there may be any variation as to the extent and development of these membranes. They may be sufficiently loose so that they pass in front of the gut like a loose, superficial veil, which has no influence whatever upon the functioning of the gut. On the other hand, the membrane may be so thickened, so short and so placed as to cause very serious distortion, compression and kinking of the lumen of the gut. In the well-developed, extensive membrane, there may be areas of thickening which cause distortion and compression of the gut at the place where they are situated, while the major portion of the membrane may be exerting no disturbing influence. The thickenings in such membranes are most apt to be situated at the hepatic flexure, at the middle of the ascending colon, and at the beginning of the ascending colon. Frequently the thickenings at the hepatic flexure and beginning of ascending colon are at the edges, upper and lower, of the membrane, while there is very frequently a third thickened band at about the middle of the membrane, running across the middle of the ascending colon. Usually the upper edge of such extensive membrane runs obliquely from above downward and inward, arising from parietal peritoneum just above right edge of liver, while the lower edge, as a rule, runs obliquely from below upward and inward, the membrane thus being somewhat fan-shaped with the spread of the fan along the right flank, where it is fused with the parietal peritoneum. These membranes usually can be slipped freely over the true peritoneal coat of the gut. They mostly fuse with the peritoneum of the gut along its anterior convexity, but may cross it and fuse with the inner mesocolon. Sometimes they are somewhat thinner than normal peritoneum and show many fine blood-vessels which run transversely to the long axis of the gut. The origin of the membrane from the right flank is practically always upon a level with the posterior wall of the gut so that in passing across in front of the gut it necessarily goes well forward and then inward. When the bands associated with the membrane begin to

shorten, it is readily understood how the intestine must be compressed and kinked and distorted.

Another anomalous formation is occasionally seen in the distribution of the great omentum. Instead of its right border being situated slightly to the left of the hepatic flexure, the origin of the omentum passes around the hepatic flexure and down the front of the ascending colon for a variable distance. The effect of this unusual distribution of the omentum is nearly always to firmly fix together the ascending colon and beginning of transverse colon so that they are in immediate contact, frequently to a point down to the middle of the ascending colon and occasionally even down to the upper end of cæcum. The effect of this distribution is to cause a sharp angulation at the hepatic flexure and to cause interference with the proper peristalsis of both limbs of the gut. Another modification of this type of omental anomaly is that in which the right edge of the omentum passes obliquely downward and to the right across the beginning of ascending colon, or upper end of cæcum, and becomes fused with the parietal peritoneum on the outer side of the gut, or becomes fused with, or adherent to, a true pericolic membrane.

Another element often related to the etiology of the symptoms in these cases is the circumstance of adhesions between the omentum and the operative scars which have been made in a more or less vertical direction through the abdominal wall, for many of these patients have been subjected to appendectomy or exploration without benefit. Where these adhesions have become somewhat thick and firm, the transverse colon is usually pulled downward, and not infrequently the adherent omentum passes obliquely across the ascending colon, or cæcum, and causes interference with its function either by pressure or by adhesions to the gut. The effect of these anomalous membranes, whether by distortion, angulation or compression, is to interfere with the proper peristaltic progress. There results a stasis in the cæcum and part of the ascending colon with the natural result of fermentation occurring in the gut contents. After a time the cæcum begins to dilate and to lose its strength, the ileocæcal valve may become incompetent and ileac stasis and regurgitation through the ileocæcal valve result; also after a time the appendix begins to give symptoms of irritation which, to my mind, are the result of this gradual distention of cæcum, resulting in back pressure, which interferes with the proper emptying of the appendix. Also the fermentation in the cæcum is apt to cause irritation, both to its own mucous membrane and to that of the appendix.

The experience with this whole group of cases has led to the conviction that many of the so-called chronic appendices are the result of disturbances of just this type. If this be so, the failure of appendectomy to cure, in a high percentage of cases of so-called chronic appendicitis, is readily explained because the removal of the appendix does not deal with the essential causative factor of the trouble, the appendix itself being involved only secondarily in the development of this condition.

Concerning the derivation of these anomalous membranes, there has been

much discussion. One group believes them to be entirely congenital and to be the result of anomalies developed during the process of fusion of the peritoneum after the rotation of the gut. Konjetzny, in a series of dissections on new-born infant cadavers, has found them present in from fifteen to twenty per cent. of children. Harvey, of New Haven, has also dissected a large series of infants and has also found these membranes present in from fifteen to twenty per cent. of the cases. His work is very inclusive and conclusive in favor of these membranes being purely developmental rather than the result of inflammatory activity in the digestive tube. Nevertheless, there are many surgeons who maintain that these membranes are entirely the result of chronic inflammatory conditions, and attempt to explain their presence in new-born children on the basis of a prenatal inflammatory process. While such inflammation has been recorded as present in several fœtuses, it is difficult to believe that such prenatal inflammation would occur in from fifteen to twenty per cent. of the children born. It would also be curious if this inflammatory process, both prenatal and postnatal, should elect to involve the various circumscribed areas in which they are found, to the exclusion of the major part of the peritoneum. It is also suggestive that these areas are located just where the peritoneal fusions are most complicated, with the obvious corollary that anomalies are, therefore, most likely to occur. Moreover, in the majority of instances in adults where these membranes have been dealt with, except for the anomalous distribution, they have had all the characteristics of normal peritoneum, the two layers of which have been held together by delicate areolar tissue.

These statements can be made with the least hesitation about the hepatoduodenal group. Even in this group additional connective tissue, both within and outside of the membrane, but closely associated with it, occurs with sufficient frequency to require explanation. In the group at the duodenojejunal angle additional thickening is present in a higher percentage of cases, and in the pericolic group in a percentage somewhat higher than in either of the other two groups. These facts have led me to the conviction that these membranes are primarily the result of anomalies in the fusion of the peritoneum, and that the thickenings occasionally found result from chronic traction, or chronic irritation from toxins or low-grade infections arising within the gut. This deduction would seem to harmonize the anatomical findings in the new-born, and the varied findings in the older operative cases, more satisfactorily than any other.

Many doubt that there is any relation between these membranes and symptomatology because troublesome symptoms usually appear only after twenty, thirty, forty or even fifty years, and yet the membranes, being congenital, have always been there. This argument is without value. Cervical ribs are congenital and yet they cause no symptoms until the possessor is from eighteen to fifty years old, and some patients never have symptoms, the ribs being discovered incidentally in the examination for other disturbances. Yet in the cases that have cervical ribs with symptoms, the removal

of the ribs leads to the disappearance of the symptoms. Again, very young children with fractures of the lower end of the humerus, which have united with posterior deformity, will grow to adult life and then for the first time show symptoms of ulnar paralysis, unquestionably due to an ulnar neuritis, secondary to the fracture deformity which has been present for years. That these membranes do cause mechanical partial obstruction of the gut by angulation and constriction has been repeatedly demonstrated at the operating table. That partial obstruction of the gut causes marked and widespread interference with the orderly functioning of the digestive canal has been proven by the work of Alvarez, Keith, Cannon and others. These disorders of function are naturally followed by the symptoms which bring patients to the physician. Because the majority of these patients, who seek relief, have reached adult life, it was thought that these anomalous membranes did not cause symptoms during childhood and adolescence. However, in nearly every case, careful investigation will show that " weak stomach," " bilious attacks," etc., were common to the earlier years of life.

Moreover, C. G. Kerley, in a symposium on enteroptosis at the New York Academy of Medicine in the Spring of 1921, summarized a series of one hundred cases of infants and young children suffering from marked digestive disturbances and malnutrition. The Röntgen series in the various cases showed pictures just like those in adults where operation has verified the diagnosis of anomalous membrane. While the diagnosis in none of these children had been verified by operation, the clinical and Röntgen pictures together made it almost certain that these cases were showing early evidence of the evil effects of these anomalous membranes. Morover, in Case XIX of this series, the symptoms were very marked in an eleven-year-old child and were entirely relieved by operation. Several cases in the series later than this first fifty have been in young children (one eight years old), so that it is evident that these membranes may cause symptoms at any period from infancy onward, and that it only remains to get familiar with the characteristic evidences.

Because of the great variability in the age at which definite symptom complexes appear, as well as in the acuteness with which they appear, it has seemed necessary to work out some explanation, based on the fundamental factors concerned, which would account reasonably for these variations in the group as a whole. As time has passed such an explanation has been evolved and is tentatively presented.

The fundamental factors are (1) The anomalous membranes which are congenital and, therefore, always potentially a menace.

The variables in this factor are: (a) The distribution of the membranes; whether present in one or more of the situations previously mentioned. (b) Their size in area and length. (c) Their thickness and rigidity. (d) Their anatomical relations to the digestive tube, which influence the degree of compression, kinking and distortion caused.

(2) The vital energy, both muscular and nervous, of the individual's digestive tube.

Variables: (a) The actual muscular development of the digestive tube. (b) The balance and quality of its innervation. (c) The endocrine balance; a factor the influence of which is not definitely known, but considered of great importance by endocrinologists. (See Timme.) (d) The general vitality and nervous balance of the individual which influence the previous variables. (e) The individual habit with regard to food; both as to frequency, quantity and quality.

As long as factor number 2 is able to overcome the partial obstructions caused by factor 1, with comparatively little effort, there will be no prominent symptoms.

If factor 1 causes more definite obstruction and factor 2 continues energetic, obvious symptoms occur of which pain is apt to be a prominent one. As soon as factor 2 suffers decompensation, then dilatation, stasis and "toxæmia" dominate the symptomatic picture. These phases merge into one another. Factor 2 may be seriously decompensated by any debilitating illness whether acute or long continued, and when decompensation has once occurred the handicap is so great that it cannot be overcome and the symptoms become steadily worse. Where decompensation has not been too serious, the original balance may be partially or completely restored, and so clinical variations occur. This has been the experience in a considerable percentage of the series of fifty presented. The fact that many of them have bilious attacks, cyclic vomiting or acidosis as children, then after puberty have less trouble or even recover for a number of years, lends weight to the argument of the endocrinologist. Consideration of these factors and their variables will at once indicate the innumerable combinations which may exist and modify the clinical history and symptomatic picture at any given time. For this reason it is almost impossible to allocate symptoms definitely to one or other of the anomalous membranes. It has, therefore, seemed best to go over the symptomatology of the series of fifty, as a whole, and then to attempt to group the symptoms accentuated by the different membranes.

Of the fifty, thirty-seven (seventy-four per cent.) were females and thirteen (twenty-six per cent.) were males. The ages ranged from eleven years to sixty-five, but there were very few less than twenty years old. Symptoms of indigestion had been present for periods varying from one and five-tenths to thirty-five years before operation. In some cases the trouble was continuous, in others intermittent, but in all cases it became gradually more troublesome and disabling during the few months, or years, preceding operation. It was noticed repeatedly in the various histories that the symptoms became markedly aggravated after a debilitating illness. In many cases there is a history of digestive disturbances from infancy.

In thirteen (twenty-six per cent.) cases the appendix had been removed; twice for acute suppurative appendicitis, but in the other eleven (twenty-two per cent.) apparently with the *hope* that the digestive disturbances would

disappear, instead of which they were greatly aggravated. This was in the period when obscure digestive troubles were attributed to the effects of chronic appendicitis. One of the series had an exploratory laparotomy and another one two exploratory laparotomies without result in either case. Briefly the symptoms were: Nausea, intermittent but often frequent, in thirty-three (sixty-six per cent.) of the group. Vomiting in twenty-five (fifty per cent.). Many of them had typical recurring bilious attacks. Pain in forty-seven (ninety-four per cent.), which varied in character from acute, colicky pain (usually epigastric) to dull discomfort with a sense of distention, punctuated with gas pains (most definite in the right side). A sensation of dragging or pulling, frequently located by the patient accurately at the site where one of these anomalous membranes was pulling (proven at operation). Before operation this sensation could be relieved by posture, crouching forward or lying with pelvis elevated. Flatulence in forty-six (ninety-two per cent.). Usually very troublesome. Constipation in thirty-three (sixty-six per cent.), often of extreme degree. Diarrhœa in ten (twenty per cent.). Intermittent in most of them. (Complicating colitis.) Toxæmia, so-called, in forty-two (eighty-four per cent.). Headache, troublesome, in thirty (sixty per cent.). Loss of weight in twenty-three (forty-six per cent.), varying from six to twenty-five pounds. Disability to follow occupation in forty-nine (ninety-eight per cent.), which varied from the complete disability of a bed-ridden invalid to the partial disability of continuous discomfort with recurring exacerbations of symptoms which caused temporary complete disability. In thirty-seven (seventy-four per cent.) the disability was estimated at fifty per cent. or more, and in twenty-five (fifty per cent.) almost total disability existed. Mental inertia, lack of concentration, lack of initiative, lack of nervous stamina, varying in degree in different individuals. Constant depression. A sense of exhaustion and somnolence in the afternoon, which was prominent in many of the cases. Mental aberration of mild degree in two (four per cent.). Oral infection was present in ten (twenty per cent.). Epileptic attacks in three (six per cent.) and "fainting spells" in one (petit mal?). Typical biliary colic in two (four per cent.) followed by jaundice in one (two per cent.). There were no stones in either gall-bladder. In each case the cystic duct was distorted and kinked by a part of the membrane.

No temperature except where some complication was present.

In the hepato-duodenal group, the predominant symptoms are pain, nausea and vomiting, gradual loss of weight and stamina. The pain is in the epigastrium and when the gastric musculature is in good condition the pain is colicky and severe owing to the strong peristalsis necessary to push by the obstruction. Some stomachs hypertrophy in overcoming the obstruction and then the pain is very severe. This pain usually starts from half an hour to an hour and a half after eating, is often accompanied by sour eructations, and, often, vomiting alone gives relief. After a time the majority of stomachs fail to compensate for the obstruction, lose tone, dilate, descend toward the pelvis and crowd over to the right flank. It is my conviction that

by this mechanism and sequence of events a large proportion of "fish-hook or ptosed stomachs" are caused, especially since operative relief from the obstruction is followed by rapid improvement in the position and size of the stomach. When the stomach is dilated and ptosed there is dull, steady discomfort, sense of fullness, dragging, fermentation, anorexia, pyrosis and debility. Many of this group have complained of a sensation as if something were pulling downward in the epigastrium, causing a sickening pain. This can be relieved by postural treatment.

The clinical history and findings in all this group are so like those of ulcer that they are difficult to differentiate; however, they fail to furnish evidence that would clinch the diagnosis of ulcer. Many such cases have been explored because of suposed ulcer or biliary calculi. No ulcer and no calculi have been found and the wound has been closed without paying any attention to the membranes. The symptoms have continued.

In the duodeno-jejunal angle group the symptoms are at first quite similar since the obstruction is only slightly further along. However, the pain is just above the umbilicus, vomiting is more frequent, and the vomitus contains bile more frequently and in considerable quantity, as the pylorus is usually dilated from the back pressure. The dilated duodenum can be made out by the method of Hayes. Perhaps the outstanding feature of this group is the great depression, both physical and mental, which is present. They are the most forlorn members of the whole larger group, and yet they respond to proper operation even more quickly than the others.

In the pericolic group, pain and distention in the right side of the abdomen, constipation and the general symptoms usually grouped under the term auto-intoxication, dominate the clinical picture.

Physical examination in the early stages may frequently give but little conclusive information. Many of these patients for a long time are well nourished, even fat; their color is good most of the time and they appear to be in good health. Their chief complaints are of pain, flatulence, constipation, and easy fatiguability, which at first occur in cycles, with varying intervals of relief. As their disturbances become more frequent and persistent, and they limit the dietary more rigidly in the hope of relieving their discomfort, they lose weight; they become sallow and pasty; their general health depreciates; and they become chronic invalids, who are frequently classed as hypochondriacs and avoided by the profession.

In only ten per cent. of the group presented was there definite focal infection in the mouth or tonsils, and the elimination of these caused no marked and lasting improvement. Examination of the heart, lungs and nervous system gives evidence either of normal conditions or of complications irrelevant from the standpoint of etiology.

Repeated examinations of the abdomen, over a considerable period of time, may show nothing abnormal beyond flatulence, and possibly moderate gastric dilation and ptosis. Examination of the gastric contents shows variation in secretions, retention (absent or present), according to the

progress of the trouble, no blood, nor any other evidence which might not be accounted for by a so-called functional disturbance.

Examination of the stools shows nothing of significance beyond variations in bacterial flora; mucus, when colitis (a frequent complication) is present; no blood, or other diagnostic evidence. Moreover, the various food elements usually come through pretty well digested.

After the pathology has progressed sufficiently, certain local signs are likely to appear.

With hepato-duodenal membranes there appears a tender area localized in the mid-epigastrium, sometimes extending over to the gall-bladder. The majority show considerable dilation and ptosis of the stomach with associated physical signs.

With obstruction at the duodeno-jejunal angle, there is usually localized tenderness about 2 or 3 cm. above and to the left of the umbilicus. The duodenum is dilated and this dilation can often be made out by the method described by Hayes. There is secondary dilation of the pylorus and stomach.

With obstruction of the first portion of the colon there appears distention and tenderness in the right lower quadrant (often extending up to the border of the ribs) and, eventually, well localized tenderness over the appendix. At this stage many an appendix has been removed on the basis of a latent chronic appendicitis, causing "reflex digestive disturbances," whatever they may be.

In the great majority of these cases there has never been a frank acute appendicitis, but the appendix, so to speak, has slipped into the clinical picture very insidiously. At some one of many examinations its characteristic localized tenderness is present. Appendectomy in this group fails to give definite symptomatic relief.

"Anomalous membranes" are present in from fifteen to twenty per cent. of people.

Appendectomy for so-called chronic appendicitis, according to Gibson and others, fails to cause symptomatic cure in about twenty per cent. of cases.

These three facts taken together lead to obvious and interesting conclusions.

While the clinical history and the findings on physical examination give results which seem too indefinite to warrant a precise diagnosis, nevertheless, experience with this group will soon enable one to make a fairly accurate estimate of the conditions within a given abdomen.

The one most necessary item for correct diagnosis is a good barium series of the gastro-intestinal tract, correctly interpreted. It has been a not infrequent experience that the X-ray report has been "negative" in cases where operation has shown these anomalous membranes to be present and causing their characteristic disturbances. A review of the barium series in these cases, preceding operation, also shows features which are characteristic. Many reports merely state that "there is no evidence of ulcer" and go into no

further detail. Therefore, one must always look over the series personally in order to do justice to his patient.

Characteristic features shown in the plates of a well-developed hepato-duodenal band are as follows:

Usually the apex of the duodenum (the junction of the first and second parts) is held rather high. Sometimes as high as the lower border of dorsal xii, in the prone position, and the lower border of lumbar i, in the erect position. More often in the same relative positions to lumbar i and ii. In the majority of cases there is distinct dilation and ptosis of the stomach; the greater curvature frequently lying below the pelvic brim.

Another characteristic feature is for the pyloric end of the stomach to be well over to the right of the mid-line, and then for the pyloric antrum, pylorus and first part of duodenum to be turned upward and inward to the vertebral column. This makes the typical "fish-hook" type of stomach. It is also characteristic that the "cap" is rarely well filled out. It is frequently elongated from the downward drag of the ptosed stomach, and may be rather irregular in outline from the influence of the pressure or distortion caused by the attached membrane.

Another characteristic feature is the sharp angulation at the junction between the first and second portions of duodenum. The second portion is frequently compressed by the under surface of the liver and shows as a narrow shadow with a straight upper edge running obliquely downward to the right. Under the fluoroscope the apex of the duodenum is more fixed to manipulation than usual and there is frequently marked tenderness to pressure at this point. As a rule there is no deformity of the cap which is sufficiently definite in repeated pictures to warrant the diagnosis of ulcer.

Peristaltic activity of the stomach varies greatly with the individual case. In those cases with very active peristalsis the stomach is not so likely to be dilated and is apt to have the so-called "cow-horn" shape. It does not reach much beyond the mid-line. These are the unusual cases previously noted and are apt to have excessive pain. The majority, however, have dilatation of varying degree depending on the degree of obstruction, and the greater the dilatation the less vigorous is the peristalsis and the more is the degree of retention. In aggravated cases the retention may be considerable even after twenty-four hours. Where the membrane causes only slight obstruction, the emptying time of the stomach is short, and there is but little dilatation.

In obstructions at the duodeno-jejunal angle evidence is obtained chiefly by fluoroscopy. The barium gets into the duodenum readily, but "puddles" in the dependent portion of the duodenum (second and third portions). There it can be seen to approach the angle and then to be pushed backward toward the pylorus and so to oscillate back and forth with the duodenum, obviously writhing in the attempt to push it along and succeeding after several attempts. Oftentimes in these cases the pictures will show the dependent portion of the duodenum to be considerably dilated, but this evidence is

not always present on the plates. In addition to distention and obstruction in the duodenum, back pressure frequently causes dilation of the pyloric ring with subsequent dilation and ptosis of the stomach.

With the pericolic membrane a characteristic feature is relatively high fixation of the hepatic flexure. Often a comparison of the gastric with the colonic pictures will show the hepatic flexure very closely related, in its position, to the fixed duodenal apex and often the hepatic flexure does not vary its position much between the prone and erect positions; *i.e.*, showing pretty definite fixation.

In addition to the high fixation of the flexure there is often a sharp angulation, the beginning transverse colon running down in contact with the upper ascending colon. There can also be seen, very frequently, definite constriction of the barium shadow at, or near, the flexure. Between this and the cæcum the large intestine is usually dilated and this dilatation increases downward to the cæcum. Where there are several transverse, thickened bands in the pericolic membrane, the outline of the cæcum and the ascending colon will be distorted. In many of the pictures taken after the barium enema incompetency of the ileocæcal valve is evident. There is also, nearly always, a definite stasis in the cæcum and the ascending colon which may persist for twenty-four, forty-eight, or even a greater number of hours. The "club-shaped" cæcum and ascending colon is characteristic. In the majority of these cases, if they have escaped appendectomy, the appendix receives the barium early and retains it throughout the examination. Usually during a fluoroscopic examination there will be found marked tenderness over the appendix, over the hepatic flexure, and often over the intervening colon.

With the history, symptoms and physical findings previously noted, and the group of pictures showing these characteristics, one may be reasonably sure of finding one or more of these anomalous membranes causing disturbance. When the diagnosis is reasonably assured, treatment can be carried out on definite lines.

Primarily, every case in these groups should be in the care of a competent internist over a long period of time. Many of them, by means of a medical régime, logically adapted to the individual case, can be made about as comfortable as the average human being. It has been repeatedly observed that individuals who suffer much under their usual conditions, will be almost entirely free from their symptoms during a holiday in the country or woods where they can lead an out-of-door life, and be free from their usual cares and worries. This, to my mind, represents a rebalancing of the opposing factors previously tabulated (page 19). Return to the ordinary duties of life is followed by a tendency to again upset the balance. In the bad cases the relief during the holiday is less complete and the later relapse is very rapid.

When, in spite of good medical care during months or years, in spite of periods of improvement, there is a general tendency for the symptoms to become more continuous and severe, with corresponding disability, relief by surgical means is indicated. The cases in this series have been treated

on these principles with two resulting advantages; no unnecessary operations have been done; and, inasmuch as the same medical men have followed their cases for long periods, both before and after operation, the interpretation of results is not biassed by a one-man surgical opinion. Because of the length of this paper no review of the various methods of surgical attack will be attempted, but merely a statement made of the methods used in this group, with the results that have been obtained.

The Incision.—With one or two exceptions the incision has been a transverse right rectus, placed from 1 to 3 cm. above the level of the umbilicus, according to the patient's conformation. It may be extended outward, splitting the flank muscles, or it may be enlarged inward by splitting the anterior and posterior sheaths of the left rectus and then retracting that muscle to the left. This incision, discussed by Moschcowitz years ago, has marked advantages, both immediate and remote, and some slight immediate disadvantages.

Advantages.—1. Immediate: There is perfect exposure, with very little retraction, of the chief focus of trouble; *i.e.*, the right upper quadrant, giving ready access to the liver, gall-bladder, pylorus, duodenum, head of pancreas, hepatic flexure and transverse colon. With great ease the ascending colon and cæcum can be explored, especially the outer gutter, so that pericolic membranes can be readily identified and attended to, and the cæcum and appendix (if still present) can be brought into the wound for convenient removal of the appendix. The duodeno-jejunal angle and dependent duodenum can be seen and manipulated, as necessary, through the inner end of the wound after the omentum and transverse colon have been withdrawn and protected in hot wrappings. By proper retraction and illumination all these structures can be seen as well as felt. The omental adhesions to previous vertical scars can be freed with the minimum traumatism. In addition, the inserted hand can palpate the kidneys, fundus of the stomach, spleen, splenic flexure, descending colon and pelvic organs. With a little care there need be no damage to the muscular innervation so that healing both immediate and remote is favored.

2. Remote: The wound heals with a thin, transverse line scar which shows almost no tendency to spread. It adds merely another "linea transversa" to the rectus which is not damaged thereby. Except in a few unfortunate cases of wound infection there seems to be no tendency to secondary hernia. Such adhesions as occur, during healing, between omentum and the scar are in a transverse line at about the level of transverse colon and, therefore, are so situated as to cause no interference with the digestive tube. Indeed, not many years ago, suturing the omentum transversely to the anterior abdominal wall, in order to make a shelf for the stomach, had quite a vogue in the surgical treatment of gastroptosis, and there were many reports of symptomatic cure following this procedure. The adhesions following laparotomies by vertical incision, as seen in certain ones of this series, cause much

more tenderness about the scar, cause more definite symptomatology, and on exploration often show marked distortion and compression of the colon.

The Disadvantages.—1. It takes more time both to make and to close the wound, but not so much more as to constitute a serious disadvantage. 2. There is a tendency for the cut ends of the rectus to ooze after closure, and occasionally there will be a late discharge (twelve to twenty days after operation) of bloody serum from some portion of the wound. This, as a rule, is sterile and delays wound healing only slightly. Occasionally a staphylococcus is present and there is additional delay. Two post-operative hernias only occurred in this series and followed such an infection.

When the peritoneum is divided in the average case, the hepatic flexure appears at the outer angle of the wound and the greater curvature of the stomach (usually pyloric antrum) fills the remainder and major portion, showing that stomach extends far below and much to the right side of where it belongs. Exploration usually shows a sharp bend backward in the pyloric antrum with the pylorus and first portion of duodenum running backward, upward and inward to the duodenal apex, which is firmly moored to the cystic duct by one part of the membrane as previously described.

By retracting the stomach downward and to the left, the hepatic flexure downward, and the liver and gall-bladder upward and to the right, the hepato-duodenal membrane and its accessory variations can be clearly demonstrated. Without this retraction the membrane might escape notice, since the position on the operating table causes the viscera to slide upward and so causes relaxation of the membrane. Also this retraction is essential to indicate the mechanical disturbance caused by the membrane when the patient is in the vertical position. When the membrane is exposed and put on the stretch, it is divided by scissors, parallel to and a little below the gall-bladder. The incision is continued through the anterior layer of the gastro-hepatic omentum a sufficient distance to permit mobilization downward and forward of the duodenum and pylorus. Usually the membrane contains no vessels of significance and section is bloodless. Just above the pylorus where there are often vascular bands, it may be necessary to divide between double ligatures to get sufficient mobilization. The raw surfaces thus exposed are covered in by a continuous catgut Lembert suture of the peritoneal edges, to minimize the post-operative adhesions. The final result in the average case brings the apex of the duodenum forward and downward to lie near the fundus of the gall-bladder (forward 6 to 10 cm. and downward 4 to 8 cm.), so that the axis of stomach, pylorus and duodenum form an easy, natural curve instead of the elongated, angulated line previously present. The distortion, kinking and compression disappear under the eye. When gall-stones or cholecystitis are present, cholecystectomy is done.

In obstructions at or near the duodeno-jejunal angle two procedures have been followed: 1. When the obstruction was obviously due to kinking, distortion and compression from membranes, a plastic operation was done to restore the normal position and mobility of the angle. 2. When the obstruc-

tion was apparently due to compression by the superior mesenteric vessels, duodeno-jejunostomy between upper jejunum and the dilated dependent duodenum (third portion or junction of second and third portions) was done. Some of these were done without dividing the layer of inferior mesocolon overlying the duodenum, but rather using it as though it were the peritoneal covering of the duodenum. In others the overlying mesocolon was divided and the duodenum somewhat mobilized for greater convenience, according to the technic described by Kellogg. Whether by chance or otherwise the group in which the mesocolon was divided were much more uncomfortable for the first few days after operation. On the other hand, this method avoids the mischance of injuring a large vein which runs obliquely upward and to the left across the third portion of duodenum, a mischance which fortunately did not occur in the other small group.

In choosing between the plastic mobilization and duodeno-jejunostomy, the results, as will be seen in a later paper in this small group of cases, indicate that the anastomosis is invariably the better procedure. Kellogg stresses this point. The anastomosis should be of generous size (4 to 5 cm.), and where the mesocolon is split, its edges should be tacked to the duodenum just as to the stomach in gastro-enterostomy.

In dealing with the pericolic membranes the guiding principle has been to cause just as little traumatism as is necessary to release the colon from kinking, compression and distortion. Therefore, thickened bands or cords have been divided (between double ligatures where vascularity demanded it) and the remaining membrane has been divided parallel to the outer side of the gut. The gut expands at once so as to separate the divided ends and edges from 5 to 7 cm. Inasmuch as the true peritoneal coat of the gut is usually not adherent to the membrane along the outer wall of the colon, there should be no great tendency for post-operative adhesions to form between the gut and parietal peritoneum where the membrane has been divided and its edges separated. Where bands and cords have been divided between ligatures the raw stumps have been inverted by catgut sutures. Complete removal of pericolic membrane is advocated by a number of surgeons. Since these membranes are very frequently adherent to, or fused with, the true peritoneal coat along the anterior summit of the gut, this procedure has seemed to me both to waste time in the actual dissection, and to really prejudice the final outcome by necessarily causing true unperitonealized areas along the summit of the gut which would almost surely adhere to parietal peritoneum during healing.

Where the origin of the omentum has extended around the hepatic flexure and down the ascending colon, causing sharp angulation at the flexure, the omentum has been split and the two limbs of gut freed from each other. The raw edge on the left side has been turned in so as to leave the omentum free and minimize adhesions, and the right side turned backward and tacked to the inner side of ascending colon, so as to minimize recurrent deformity. When omentum has been adherent to the scars of previous

operations, it has been carefully separated right at the parietal peritoneum. The raw stump of omentum has been turned in upon itself by catgut suture so as to try to prevent it from again adhering. Where the parietal peritoneum at the scar is denuded over only a narrow line it is often possible to fold it in by a running catgut suture and so diminish the likelihood or extent of post-operative adhesions. The appendix is always removed when present. After the abdomen has been completely explored, and such of these conditions as exist in the individual case have been cared for, the wound is closed by layer sutures, without any drainage.

From the very start frequent changes are made in the position of the patient, who within a few days can voluntarily roll about unaided and without discomfort. The first post-operative dressing is done on the tenth day and the skin and tension sutures removed. They sit up on the seventeenth day and leave the hospital a few days later. After the twelfth to the fourteenth day light abdominal massage is started and is gradually increased in vigor, special attention being given to the right upper and lower quadrants. This massage is continued for from four to six weeks, by which time the region of the scar is usually flexible and free from tenderness, and the abdomen as a whole seems normal to physical examination. The importance of this early massage has seemed increasingly evident as time goes on.

Results.—The immediate post-operative period was usually uneventful except for the customary discomforts. There was one subphrenic abscess without known cause. Recovery followed its evacuation. Three cases developed deep wound infection on the ninth, tenth and twelfth days. Two of them developed subsequent hernias. One was successfully repaired under local anæsthesia. One refused to have a repair. The third case did not develop hernia. One case had a slight discharge of serum from the outer angle of the wound about the tenth day. There was no delay in the final healing. This is a heavy incidence of defective wound healing. Many plausible reasons could be advanced but perhaps the plain statement of fact is best. There was one death in the series from pneumonia on the fifth day. In the remaining cases wound healing was by solid primary healing. After the first few weeks practically all of these wounds are free from tenderness to pressure. After the first few days of post-operative discomfort have passed the patients volunteer interesting facts.

Those who have had a sense of dragging from hepato-duodenal membrane state that it has disappeared; the old tendency to fulness, gas eructations and nausea have gone; real appetite, which has been absent for weeks, months or years has returned; foods can be taken with comfort which had always disagreed previously. The bowels begin to act with far less help than has been necessary for a long period, and in very many cases after the return to regular duties, no cathartics at all are necessary. Their faces lose the drawn, haggard, worried expression so common to the group, and the sallow, pasty complexion begins to clear up. Many of them state that the sense of mental depression and lack of power to concentrate which has

prevented efficiency has disappeared within a very short period. They gain in weight (five to thirty pounds within the first six months) and their strength and endurance are greatly increased.

In general terms, the longer the duration of the disabling symptoms preceding operation the slower is the rate of recovery. This is especially true where so-called auto-toxæmia has been present. Also, the older the patient, the less prompt and complete is the recovery likely to be, although there are many exceptions. Where colitis and perihepatitis, one or both, are present as complications, the recovery is slower, more irregular and less complete.

Along with the improved general condition there are corresponding signs of improvement on examination of the abdomen. The stomach rapidly diminishes in size to more nearly its normal location, losing a large part of its ptosis and enlargement to the right of the median line. The pain, distention and tenderness localized in the right side of the abdomen, especially the lower quadrant (in the cases of pericolic membrane), disappear within a few weeks.

In five of this present series obstruction was present at, or near, the duodeno-jejunal angle. In four of them relief was attempted by plastic work instead of by duodeno-jejunostomy. While they have shown definite improvement, the result has not been nearly so satisfactory as in a group, later to be published, where the anastomosis was done. In the fifth case the anastomosis was done and much improvement occurred, but other non-digestive troubles have prevented a real recovery of health and strength.

In only one of the group of fifty was a post-operative series of pictures obtained (about eleven months). These showed the stomach smaller and more vigorous, the pylorus definitely lower, and the axis of the cap slanted almost horizontally to the right as contrasted to an almost vertical axis before operation. Also the colon showed no stasis, and the dilatation of cæcum had disappeared. She no longer suffered from constipation. Some three years later the abdomen was opened again. The pylorus and beginning duodenum were suspended from the anterior edge of the right lobe of the liver by a thin fold of adhesions about 4 cm. long, which in no way distorted or compressed their lumen. They were visibly anterior to their position before the first operation by 10 cm. and at a lower level by 5 cm. This one case proves the possibility of permanently changing the position of the stomach outlet and also the direction of its axis with freedom from recurrence of kinks or compression.

Tabulating the results with regard to symptomatic cure furnishes interesting data. The terms "cured," "much improved," "improved," "unimproved," "died," have been used. "Cured" is applied only to those cases who are perfectly free from all digestive discomforts, restrictions in diet, constipation, etc., and in whom there has been full return of nervous and physical energy and capacity to do their work. "Much improved" has been applied to those who have returned almost to normal, but who still

have slight disturbances of digestion of one sort or another, or some remaining impairment of vigor. At least nine of the twenty-six so tabulated might fairly have been classed as cured, since they are as well as the average person, but they have slight disturbances and so were placed in this second best group. "Improved" includes those who were definitely benefited but were not able to resume their full duties in life.

This table is made up on the basis of written reports from the patients in answer to questionnaires. The time of the latest report after operation is specified in the abstract of each individual history. These times have varied from three months to seven and one-quarter years. Of the sixteen cured, fourteen were followed from two and one-half to seven and one-quarter years. Of the twenty-six much improved, eighteen were followed from two and one-half to four and one-third years, sufficient time in each group to get a fair estimate of end results.

It will be seen that the only "cures" occurred in the upper two groups, and that the percentages are fairly high. If the "much improved," who were

			Cured	Much Improved	Improved	Unimproved	Died
			%	%	%	%	%
1.	30 Hep.-Duod. and Pericolic...	11	(36⅔)	*16 (53⅓)	1 (3⅓)	1 (3⅓)	1
2.	13 Hep.-Duod. and H. D.-colic.	5	(38.4)	*6 (46)	0	2 (15.4)	
3.	3 Hep.-Duod., Duod.-Jej. and Pericolic.....	0		2 (66⅔)	1 (33⅓)		
4.	1 Duod.-Jej. and Pericolic.....	0			1		
5.	1 Duod.-Jej. and Hep. Duod..	0		*1			
6.	2 Pericolic.....	0		1	1		
	50	16	(32%)	26 (52%)	4 (8%)	3 (6%)	1 (2%)

1. *9 practically cured.
2. *1 practically cured.
3. *1 practically cured.

practically all returned to full duty, are admitted as qualified "cures," the percentage of highly satisfactory results in the first two groups would reach ninety per cent. and eighty-four and four-tenths per cent., respectively. In similar manner the cures in the whole group were thirty-two per cent.; or adding the much improved, who were all back at duty and nearly well, one would get eighty-four per cent. highly satisfactory results. In the remaining four small groups in which no "cure" was obtained, it will be noticed that disturbance about the duodeno-jejunal angle was present in three groups, and in all but one (Case No. XLIX) of these cases plastic work was used to relieve the obstruction rather than duodeno-jejunostomy.

Inasmuch as both hepato-duodenal and pericolic membranes were present in both of the upper groups in which cures were obtained in high percentage, it would seem that the duodeno-jejunal angle complication and its method of treatment were responsbile for the relatively poor results in groups 3, 4 and 5. This deduction is borne out by the much better results obtained in a small group to be published in a later series in which duodeno-jejunostomy was the method used. This confirms the deductions reached by Kellogg, previously published in the series reported by him. In most of these cases

which were only moderately improved, or were unimproved, there were complicating factors other than the membranes themselves which helped to prevent the attainment of satisfactory results. (See case histories.)

Summary

1. Anomalous membranes are present in from fifteen to twenty per cent. of new-born infants.

2. They result from atypical peritoneal fusion during fetal life. Many of them are probably modified by later pathological changes due to continued traction, irritation, or low-grade inflammation.

3. They occur in the hepato-duodenal region, at the duodeno-jejunal angle, and about the cæcum, ascending colon, hepatic flexure and beginning transverse colon.

4. Two or more of these regions are involved in the majority of individual cases. Groups of cases illustrating the results of treatment of the membranes found in the individual locations have been published by various men. Hepato-duodenal group by Harris; duodeno-jejunal groups by Kellogg; and pericolic group (Jackson's membrane) by Jackson, but sufficient emphasis seems not to have been put upon the fact that two or more of these lesions exist in the majority of individuals who fall within the whole large group.

5. They cause mechanical disturbances, fixation, angulation, compression and torsion of the digestive tract resulting in partial, continuous and often increasing obstruction. This, in turn, frequently causes dilation proximal to the obstruction.

6. Symptoms result when the obstruction becomes greater than the peristaltic efficiency can easily overcome. This balance may be gradually lost over a long period of time, with resulting slowly increasing symptomatology. It may be suddenly lost as the result of a prostrating injury or illness, the obstruction remaining constant while the viscus, becoming atonic, is no longer competent to overcome it. Sometimes the viscus regains its relative power and the symptoms improve. Often the viscus can never overcome the handicap and symptoms are continuous and progressive.

7. For a long time it was thought that these cases developed symptomatology only after twenty years or more of age. The investigations of Kerley in infants and children suffering from malnutrition, cyclic vomiting, recurrent acidosis, etc., show that abdominal examination and studies of the barium gastro-intestinal series give precisely the same findings as do the older cases in which operation has demonstrated the lesions, and caused cure in a high percentage of cases. This would indicate that symptoms appear in definite form at any period of life when the balance of peristaltic efficiency against the partial obstruction is lost.

8. The symptomatology consists of: Digestive disturbances previously described; general nutritional disturbances; nervous debility, usually termed neurasthenia (and occasionally mild psychosis). At some period the appen-

dix is likely to become tender to pressure, is assumed to cause the symptomatology by "reflex action," whatever that may be, and is removed, with failure to cause improvement.

9. There are usually tender spots in the mid-epigastrium, over the appendix, over cæcum and ascending colon, and over the duodeno-jejunal angle, depending upon the presence of the various lesions. There is varying dilation and ptosis of the stomach, and varying dilation of cæcum and ascending colon. In marked obstruction at the duodeno-jejunal angle the dilated duodenum can be made out.

10. Examination of gastric contents and stools gives no evidence of value as a rule.

11. The most important element of evidence is found in the barium gastro-intestinal series. It must be a good series, with sufficiently frequent plates. The plates must be read by one experienced in these cases. It is common to receive typewritten reports that the plates are "negative" or that the digestive tract is "normal" when inspection of the plates shows characteristic evidence to be on the plates. Fluoroscopy should be done by one experienced in these cases, especially to determine the presence of obstruction at the duodeno-jejunal angle, indicated by marked distention of dependent duodenum, with writhing and rushing of the contents back and forth. The pictures are not quite so conclusive, and on the operating table the duodenum may be empty and the condition not so obvious.

The plates are likely to show:

Hepato-duodenal Membrane: The stomach dilated, ptosed, with varying peristaltic activity. With or without retention. The apex of duodenum fixed high, sharply angulated and showing little mobility. The cap is often deformed but not in the way characteristic of ulcer. The second part of duodenum is likely to be compressed and narrowed.

Duodeno-jejunal Angle Obstruction: Dependent duodenum, if dilated, may or may not show definitely on the plates.

Pericolic Membrane: The hepatic flexure shows high fixation (often near the duodenal apex), angulation, and often transverse colon descends in contact with ascending colon. Cæcum and ascending colon are dilated. Ascending colon often showing constriction at about its middle. Appendix, if still present, usually retains the barium for long periods. Ileocæcal valve is often incompetent.

12. Treatment: (a) Prolonged medical. (b) Surgical. Best incision is "transverse right rectus," as it gives best exposure of the whole field, and post-operative adhesions are in least troublesome situation. (c) Post-operative. Abdominal massage. Medical supervision of diet and general hygiene, etc.

Results very satisfactory, as a whole. (See table, page 531.)

NOTE.—Grateful acknowledgment is made: to Doctors Meara, Goodridge, Niles, Williams, and Painter for their interested collaboration in working out the

problems presented in the paper and for following up, before and after operation, these patients from the medical standpoint.

To Dr. John B. Walker for the privilege of assisting at operation on the first case of this type in the author's experience, and for the privilege of including this case in the group herewith published.

To Dr. H. M. Imboden for his collaboration in working out the X-ray picture interpretations in this type of cases. To Dr. L. T. Le Wald for assistance in the X-ray problems.

In giving the case abstracts all non-essentials have been avoided in order to save time and space. Ether anæsthesia was used in each case. The term T. R. R. equals "transverse right rectus." Surgical procedure is termed: "Mobilization, duodenum, mobilization, colon," etc.

In every case these terms indicate the treatment of the corresponding membranes according to description of the technic in the body of the paper. Also in nearly every one of the cases there has been prolonged medical treatment preceding consideration of operation. In some few cases where the condition was obviously unpromising from the medical standpoint, this preliminary treatment was not undertaken.

One of the things that experience has taught the group interested, is that an *early* barium series is very likely to clear up the diagnosis and make treatment far more definite and logical. It is interesting to note in these cases that the longer the period which has elapsed between operation and report, the greater improvement seems to have occurred in the majority of cases. In the few unfortunates who have been classed as "unimproved" time has seemed to make no difference. The latest reports coming in have necessitated revising the group of results because of the reports being much better than those received one and two years before. This is a very satisfactory feature because the one fear has been that after a long period of time post-operative adhesions might cause a recurrence of the old disturbances. This seems not to be the case.

The case histories have not been given in the order of their numbers but have been grouped according to the combinations of membranes found, so that the similar cases will be all together for the convenience of the reader in working out symptomatology, procedure and results. Cases XLVI, XLVIII and L have been included in the group of hepato-duodenal-pericolic membrane group, because the angulation at duodenal cap was only a variation of that in the true hepato-duodenal membrane type.

Group No. 1.—Hepato-duodenal membrane: Case Nos. I, II, III, X, XI, XII, XIV, XIX, XXVIII, XXIX, XXX, XLIV, XLVII.

Group No. 2.—Hepato-duodenal membrane and pericolic membrane: Case Nos. IV, V, VI, VII, VIII, IX, XIII, XV, XVI, XVII, XVIII, XX, XXII, XXIII, XXIV, XXV, XXVII, XXXII, XXXIII, XXXIV, XXXV, XXXVII, XXXIX, XL, XLI, XLIII, XLV, XLVI, XLVIII, L.

Group No. 3.—Hepato-duodenal membrane and duodeno-jejunal membrane: Case No. XXI.

Group No. 4.—Duodeno-jejunal membrane, pericolic membrane: Case No. XXXI.

Group No. 5.—Pericolic membrane: Case No. XXXVI.

Group No. 6.—Hepato-duodenal membrane, duodeno-jejunal membrane, pericolic membrane: Case Nos. XXXVIII, XLII, XLIX.

CASE I, C. R., F. Twenty-seven years. Previous operations: appendectomy and exploration of gall-bladder. Duration of symptoms, always. Nausea and vomiting since childhood. No pain until 1908 when she had a sudden attack in the lower right side with nausea, vomiting and fever. Recurrences until March, 1909, when a chronic catarrhal appendix was removed. Since this operation there had been pain between the umbilicus and gall-bladder which was increased by exercising, by bending backward and by fatigue. Nausea and vomiting became worse. Gall-bladder exploration March, 1914. No stones or inflammation. Wound closed. Symptoms grew worse steadily. From August 1, 1914, to September 23, 1914, she was confined to bed most of the time.

P. Ex.: She is a large, well nourished, rather nervous woman. Weight 147 pounds. Scars of two operations, upper scar quite tender. General examination otherwise negative.

X-ray series: Showed "many apparent adhesions between the stomach, pylorus and gall-bladder." Pre-operative diagnosis: Hepato-duodenal membrane.

Operation: 9-23-14. Incision: vertical. Findings: Stomach: somewhat enlarged. Duodenum: apex, held high and kinked by definite hepato-duodenal membrane. Procedure: Membrane divided; edges sutured. Convalescence: uneventful.

Result: Pain, nausea and vomiting were relieved at once, and have never since recurred. Cured, seven years.

(For the privilege of including this case, which was the first one I had ever seen, and for the privilege of assisting at the last operation, I wish to express my acknowledgment to Dr. John B. Walker. It was perhaps the most dramatic case in the whole series.)

CASE II, L. S., F. Forty-eight years. Duration of symptoms: seventeen years. Nausea and vomiting; frequent. Pain, constant. Flatulence and constipation with considerable loss of weight. Much headache, exhaustion, almost complete disability.

P. Ex.: Pale, sallow woman weighing 140 pounds. Very neurasthenic. Examination of chest, urine, stools, gastric contents: negative. Abdomen: distended. Tender spots were present over appendix, over left iliac fossa and sigmoid which was spastic, and just above and to the right of the umbilicus, and just beneath the free border of the right ribs.

X-ray series: Duodenum: fixed high. Stomach: fish-hook type, six hours retention, cap slightly deformed. Stasis in ascending colon. Appendix: visualized throughout. Marked gastroptosis in the erect posture. No gall-stones were seen. Pre-operative diagnosis: Hepato-duodenal membrane. Chronic appendicitis.

Operation: 5-15-15. Incision: T. R. R. Findings: Stomach: enlarged but showed no sign of ulcer. Duodenum: fixed to gall-bladder and liver and was markedly compressed by a hepato-duodenal membrane extending half way to the fundus of the gall-bladder and passing down across the duodenum to beginning transverse colon. Liver: showed marked perihepatitis. A small segment removed for the microscope showed normal liver cells but much thickened capsule. Appendix: atrophic. Procedure: membrane divided. Appendectomy. Convalescence: uneventful.

Result: 4 months after operation she had gained 14 pounds, felt stronger and better in every way than for years. Moved away from city and is untraceable. Much improved—four months, then lost.

Case III, G. A., F. Thirty-one years. Previous operation: ovariotomy eight years previous. Abdominal pain for years. Subject to regurgitation of sour stomach contents, much flatulence. Of late has had much pain in right iliac fossa. Has always been strong and able to work.

P. Ex.: Large, well nourished woman showing tender spots in mid-epigastrium, just below and to the right of umbilicus, and over the appendix. Examination of gastric contents and stool: negative.

X-ray series: Shows high fixation of duodenum with angulation. Cap shows constant deformity. Stomach: markedly dilated and ptosed. Empty at six hours. Barium in appendix for ninety-six hours. Pre-operative diagnosis: Hepato-duodenal membrane. Chronic appendicitis.

Operation: 3-14-16. Incision: vertical right rectus. Findings: Stomach: very much enlarged and ptosed. Distended enormously with gas two times during operation so that a tube had to be inserted and left. Duodenum: fixed high beneath the liver by a thick membrane running from the middle of gall-bladder and cystic duct to duodenum, pylorus and colon, allowing no mobility to apex of duodenum. Appendix: distended, thickened and rigid. Procedure: Gastro-enterostomy; because of thickness and vascularity of membrane, making mobilization too difficult. Appendix resected, stump inverted. Pathological report: Appendix shows involutionary changes only. Convalescence: Uneventful.

Result: Digestion normal, has to avoid greasy foods. Slight constipation. General health and comfort much better. Much improved, one year, nine months.

Case X, C. G. H., F. Forty-seven years. Symptoms: bilious attacks since childhood. At thirty-one years of age had an abdominal injury. One year later had pain in iliac fossa with fever and nausea. Thereafter, frequent abdominal pain. Constipation became more marked, worse for the last two years. During these two years much nausea, headache and lassitude, such that she was almost completely disabled.

P. Ex.: Small, fairly well nourished, sallow, neurasthenic. Examination of gastric contents, stool, urine: negative. Abdomen: somewhat distended; showed tenderness just below xiphoid and over cæcum.

X-ray series: Showed high fixation of duodenum with limited mobility. Stomach: enlarged and ptosed. Cæcum and ascending colon: showed retention with dilation. Shadows in gall-bladder region were interpreted as stones. Pre-operative Diagnosis: Hepato-duodenal membrane. Biliary calculi. Pericolic membrane.

Operation: 3-24-17. Incision: T. R. R. Findings: Gall-bladder: normal. Liver: showed hepatitis and perihepatitis. Small wedge removed. From the cystic duct and proximal gall-bladder was a membrane running across the duodenum, pylorus, pyloric antrum to transverse colon, causing distortion and kinking of the stomach and colon. Stomach: enlarged and distended with gas. Pushed well over into the right flank then curved back, inward and upward, showing a kink in the pyloric antrum. Appendix: ran up the outer side of cæcum, firmly adherent throughout. From its tip a firm band of connective tissue ran upward and inward to anterior summit of colon. This caused cæcum and colon to rotate and buckle. Omentum: came around the hepatic flexure and down the ascending colon, attached to the front of the colon. This caused rotation inward of the colon so that the ileocæcal valve lay directly posterior instead of to the inner side of cæcum. Procedure: Hepato-duodenal band was disposed of. Appendix removed and stump inverted. Omentum cleared from cæcum and ascending colon. Pathological report: Involutionary appendix. Liver capsule;

chronic perihepatitis. Liver cells normal. Convalescence: Uneventful. Improvement rapid.

Result: Digestion greatly improved. Very little pain. No nausea. Rarely constipated. Gained five pounds in weight and very much in well-being. Much improved, nine months, then lost.

Case XI, E. C. H., F. Fifty years. Previous operation: gall-stones and chronic appendix at same time. Symptoms for fifteen years. Epigastric pain, constipation, flatulence, sleeplessness, nervousness and lack of strength. Following her operation there was no improvement. Symptoms became more severe until now she is disabled. She has always been fat.

P. Ex.: Short, very fat woman of good color. Examination of chest, gastric contents, stool, blood, urine and pelvic viscera: negative. Finger joints show chronic arthritis. Abdomen: prominent, very fat wall, shows long right rectus scar. Great tenderness all along scar, especially at upper end. Also marked tenderness midline just below the xiphoid.

X-ray series: Show high fixation and angulation of duodenum both erect and prone positions. Pre-operative Diagnosis: Hepato-duodenal membrane. Adhesions.

Operation: 6-19-17. Incision: T. R. R. Findings: widespread adhesions everywhere; between omentum, anterior parietal peritoneum and edge of liver nearly to median line. When these adhesions were freed the stomach was exposed. The upper anterior surface of pyloric antrum was adherent to the bed of the gall-bladder, which had been removed. Running from the under surface of liver across front of stomach was a band of connective tissue 2 cm. wide, quite vascular, causing kinking and compression almost like an hour-glass. After the stomach was dissected from the gall-bladder bed a perfectly typical hepato-duodenal membrane 1 cm. long, absolutely inelastic, was found holding the duodenum high and causing compression and angulation. Procedure: The bands were divided and the stomach mobilized. Convalescence: Slow and unsatisfactory. On the seventh day there was a slight suppuration at the inner angle of the wound. On the twenty-first day she sat up. On the twenty-second day had pelvic pain. Urine showed culture staphylococcus albus. Home on the thirty-fifth day.

Result: She was unwilling to coöperate and for two years her report was such that she was classified as a complete failure. Failure, four years, six months. (Later report.)

Case XII, M. S., F. Twenty years. Previous operation: Appendix removed two years ago. For four years had periodic headaches which were becoming steadily worse. Nausea and persistent vomiting with abdominal pain. After removal of the appendix no relief of symptoms but dull, steady pain in the right side followed. There is no constipation, no loss of weight. Pain is worse on standing; is slightly relieved by crouching and by abdominal belt. She loses about thirty per cent. of her time from her work.

P. Ex.: She is of small size, well nourished and of good color. Examination is negative with regard to everything except the abdomen, which shows a two-inch appendix scar at the outer edge of the right rectus. Edges tender all about the scar. There is marked tenderness in the mid-epigastrium to the right of the middle line. There is not much gas.

X-ray series: Show high fixation and immobilization of the duodenum with marked gastroptosis and coloptosis. There is persistent unevenness of the cap and much elongation of first portion of duodenum. Pre-operative Diagnosis: Hepato-duodenal membrane. Adhesions—post-operative.

Operation: 7-24-17. Incision: T. R. R. Findings: Duodenum: held firmly under the cystic duct by a firm hepato-duodenal membrane running half way out to the fundus of gall-bladder. Stomach: dilated moderately. Small omental

adhesion to the upper end of appendix scar. Procedure: Before the division of the hepato-duodenal membrane, the duodenum, which was angulated and compressed, could not be displaced downward. The fold was divided transversely and with little blunt dissection the duodenum was mobilized downward 7 cm., and was freed from kinking and compression. Adhesions and omentum were separated from appendix scar. Convalescence: Uneventful.

Result: Absolutely free of symptoms. Works one hundred per cent. of time. Cured, four years, six months.

Case XIV, A. H. M., M. Forty-five years. Symptoms twenty-eight years. Pain in epigastrium increased by swimming, rowing, erect posture, or by anything which puts tension on the rectus muscles. The pain was almost constant and increasing in severity. Could not lie on stomach or left side. Some relief by crouching. After a time headaches, gastric pain, constipation, flatulence, nervousness, insomnia, anorexia and loss of weight became increasingly troublesome. Fourteen years after beginning of pain an exploration was made through a median, upper abdominal incision. No ulcer or gall-stones were found and the wound was closed. Symptoms became worse. There was twenty-five to thirty per cent. disability with regard to his professional work and he never worked with any comfort.

P. Ex.: Five feet eight and one-half inches high, weight 104 pounds. His frame was slight, was emaciated, pale, haggard, with the drawn face of chronic suffering. He stands and works in a slightly stooped attitude because of the relief thus afforded. Examination, except for abdomen, negative. Abdomen: shows median scar which is very tender throughout, especially to the right of its upper end. Cannot endure slightest pressure. There is increased localized tenderness just above and to the inner side of R. A. S. S. The abdominal wall is retracted and scarcely moves during respiration.

X-ray series: Show high fixation of pylorus, duodenum and hepatic flexure. There is deformity of the cap and sharp angulation of the duodenum. Slight stasis in the ascending colon. Pre-operative Diagnosis: Hepato-duodenal membrane. Pericolic membrane. Adhesions.

Operation: 8-17-17. Incision: T. R. R. Findings: Adhesions between omentum and the old median incision. Pylorus: adherent to fundus of gall-bladder and duodenum ran backward along the gall-bladder in contact throughout its first portion. There was a firm band running from the pyloric end of lesser curvature of stomach to the edge of liver just to the left of round ligament. Stomach: moderately dilated and ptosed. Cæcum and appendix: were just beneath the right lobe of liver and ileocæcal valve at postero-external relation to inverted cæcum. A peritoneal fold ran from the cæcum upward beneath and to the right of appendix to the liver edge. From the cæcum the large gut went downward and at about the middle of ascending colon turned upward to follow its normal course. Procedure: Adhesions to old scar were separated. Adhesions between stomach and liver were divided. Adhesions between pylorus, duodenum and gall-bladder divided; duodenum mobilized downward 7 cm. Appendix: removed. Cæcum: mobilized downward to its normal situation. Convalescence: Uneventful.

Result: After four and one-half years still has epigastric pain and some headache. Has no gas, no constipation. Appetite much better. Has maintained a gain of ten pounds. General health and capacity for work much increased. Much improved—four years, six months.

Case XIX, C. S., F. Eleven years. Instrumental delivery following difficult labor. Had cyanotic attack on second day. Up to the age of seven she developed normally except for digestive disturbances. When seven she began to have attacks of petit mal. Her digestive disturbances grew worse; was subject

to headache, nausea, vomiting and marked constipation. In spite of a good appetite and taking large quantities of food she lost considerable weight. When ten years old had her first attack of grand mal, since which there has been a number of both grand and petit mal attacks. There has been some loss of memory. When ten years old tonsils and adenoids were removed. There was temporary improvement in general health, but attacks recurred shortly afterward.

P. Ex.: Tall, fairly nourished girl, rather pale, with a pasty complexion and showing considerable acne. Examination of throat, chest, gastric contents and stools: showed nothing of moment. Abdominal examination: showed tenderness over the appendix and to the right of the median line in the mid-epigastric region. Also showed free descent of the liver on inspiration and a stomach which seemed enlarged and ptosed to percussion.

X-ray series: Showed well-marked enteroptosis. Stomach: very much dilated; marked six-hour retention; no evidence of ulcer. Duodenum: fixed high and kinked beneath the liver. Flexures of the colon were low; both below the level of iliac crest. Cæcum: was deep in the pelvis. Examination of the urinary tract and chest showed nothing abnormal. Skull: showed signs of prolonged, increased intracranial pressure. Pre-operative Diagnosis. Hepato-duodenal membrane. Chronic appendicitis.

Operation: 1-30-18. Incision: T. R. R. Findings: Duodenum: fastened high up to under surface of liver just to the left of cystic duct by a firm, fibrous band. Hepato-duodenal membrane: extended 6 cm. outward along the gall-bladder, ran across the front of duodenum to beginning transverse colon. Stomach: greatly dilated. Appendix: small and adherent to iliac fossa. Procedure: Adhesions and membrane between gall-bladder, liver and duodenum were divided and the duodenum mobilized downward about 5 cm. Appendix: freed, removed and the stump inverted, as usual. Convalescence: Uneventful. She made a perfect recovery.

Result: Three years, six months after operation all of her digestive disturbances had disappeared. She has grown rapidly in size, her color has cleared up and she has been full of energy and has made a high stand in her class at school.

Cured, three years, six months. (Her attacks of grand mal continued and exploration of the brain showed a large cyst in the right temporal sphenoidal lobe, which was evacuated.)

Case XXVIII, T. B., F. Twenty-nine years. She was well until twenty-seven and one-half years old, when she developed a steady pain in the right hypochondrium accompanied by nausea and vomiting. There was no temperature. The attack lasted two to three hours. During the succeeding eighteen months there were about twenty-five similar attacks. During that period she also had one attack of pain lower down which ran into the urinary bladder and was accompanied by strangury. Between her frequent attacks of abdominal pain her appetite was good and her bowels rarely constipated. She was somewhat addicted to alcohol and tobacco. The remainder of her history is irrelevant.

P. Ex.: Woman of medium height but large frame and fat. Good color. Examination of chest, gastric contents, stools, etc.: negative. Abdomen: prominent, wall flabby, small omental umbilical hernia. There was no tenderness over the appendix. Some tenderness over sigmoid. Just to the right of the mid-line, opposite the eighth costal cartilage is marked tenderness over an area of 3 cm. in diameter. Percussion shows a dull note in this area. Liver: not enlarged. Kidneys: negative. Stomach: does not seem enlarged.

X-ray series: Shows one shadow somewhat definite that might indicate a gall-stone. Shows stomach somewhat enlarged and ptosed. Peristalsis seemed normal. No indication of ulcer. Emptying time four hours. Duodenum: fixed high beneath liver, and angulated. Cæcum: somewhat dilated. Appendix: held

barium through examination. Ileocæcal valve: incompetent. Pre-operative diagnosis: Hepato-duodenal membrane. Biliary calculi. Chronic appendicitis.

Operation: 5-14-18. Incision: T. R. R. Findings: Stomach: much dilated, well over to the right side; turned backward, upward and inward to duodenum, which was firmly fixed by a broad hepato-duodenal membrane. Gall-bladder: contained numerous small stones. Appendix: showed several small fecal masses. Procedure: Gall-bladder removed; the stump of cystic duct sterilized and covered in by peritoneum. Duodenum: mobilized downward 6 cm. Appendix: removed and stump inverted. Convalescence: Uninterrupted.

Result: Has never had any digestive trouble since operation. Cured, three years.

Case XXIX, M. M., M. Forty years. Always well until twenty-five years old. Then recurring attacks of pain every few weeks. When thirty-three acute perforative appendicitis occurred. Operation was followed by prompt healing and much improvement in digestion. Slow recovery of strength. Whenever tired or nervous old digestive attacks would recur. His bowels have been fairly regular. His weight varies from 130 to 140 pounds. No nausea or vomiting but little flatulence. Chief disturbances are attacks of pain, nervous depression and disability that goes with them.

P. Ex.: He is a medium-sized, well-nourished man. Sallow color. Examination is negative with regard to gastric contents, stools, etc., and with regard to chest and urine. Abdomen: shows scar of the appendix operation but no tenderness is associated with it. Tenderness: just to the right of the median line slightly below xiphoid. No distention or tenderness in the cæcal region. Stomach: by percussion reaches below the umbilicus and well over beyond the median line to the right side.

X-ray series: Stomach: pulled well over to the right and fixed high up beneath the liver. No deformity of stomach or duodenum. No indication of ulcer. Peristalsis is active. Slight retention at three hours. Cæcum: seems moderately enlarged.

Operation: 5-16-18. Incision: T. R. R. Findings: There was a strong, double fold of peritoneum running from the cystic duct and proximal gall-bladder downward across to duodneum and pylorus to transverse colon. This fold caused high fixation and an obvious sharp kinking of the duodenum. Stomach: pylorus on the anterior wall was irregular; wide cicatrix with much thickening of the underlying wall. The crater of the ulcer could be palpated. There was perihepatitis on the under surface of the right lobe of liver. There were omental adhesions to the old appendix scar which were not causing any apparent disturbance. Procedure: Hepato-duodenal membrane was divided and duodenum mobilized downward. Ulcer was excised and the wound closed by three layer sutures. Convalescence: Prompt and satisfactory.

Result: Since operation there have been several periods of apparent recurrence and healing of ulcer. At present, three years, seven months after operation, he is in very good condition. Has gained weight and color. Capacity for work has greatly increased. Appetite is good; no constipation. Is troubled slightly with gas. Much improved, three years, seven months.

(It is probable that the symptoms in this case were due more to the ulcer than to membrane development, but it was there and the case is included to indicate the variety.)

Case XXX, S. M., F. Twenty-four years. Began to have digestive trouble when nine years old. One year later had gangrenous appendicitis, peritonitis and was operated upon. When eighteen years of age began to have attacks of grand mal associated with nausea and vomiting which persisted for two days after the attack, sometimes the temperature would rise to 102° F. At first the attacks

came at four to six months apart, but gradually increased in frequency until at the age of twenty-four they occurred for two to three days in succession at intervals of two or three weeks. During the intervals her appetite was good, and the bowels somewhat constipated. She had much belching of gas and frequent epigastric pain. She was always depressed and irritable. Her periods were regular and normal.

P. Ex.: She is of medium size, well nourished, brunette, but pale, and with a pasty complexion and acne. There is excessive development of hair on the head, face and abdomen. Gastric contents, stools, urine and blood show nothing abnormal. Protein skin tests—negative. Abdomen shows the appendix scar, oblique, in the right lower quadrant. There is persistent tenderness over the cæcum which is distended with gas, most marked along the inner side of the scar. Also there is marked persistent tenderness to right of median line a little below the xiphoid. Stomach is enlarged and distended with gas.

X-ray series: High fixation of duodenal apex; deformed cap; no evidence of ulcer. Stomach: dilated, fish-hook type; slight four-hour retention; peristalsis somewhat atonic. Slight ileac stasis. Cæcum moderately dilated; retains barium unduly long; somewhat irregular in outline. Ascending colon seemed constricted at about its middle. Gall-bladder, sella turcica, and teeth negative. Pre-operative Diagnosis: Hepato-duodenal membrane. Adhesions.

Operation: 5-30-18. Incision: T. R. R. Three cm. above navel. Findings: Hepato-duodenal membrane 3 cm. wide, holding duodenum high, fixed and kinked at apex. Stomach: somewhat dilated; otherwise negative. Dense adhesions between appendix scar, cæcum and omentum. Cæcum moderately dilated. Right edge of omentum passed obliquely across front of ascending colon, to which it was densely adherent, to upper end of old incision; it caused marked constriction of ascending colon. Gall-bladder normal except for above membrane. Liver and kidneys normal. Uterus, infantile. Ovaries, normal. Procedure: Hepato-duodenal membrane divided, duodenum mobilized downward 5 cm. Adhesions carefully separated; damaged omentum resected and stump inverted. Convalescence: Uneventful, except for "attacks" on the twelfth, nineteenth and twentieth days. On the twenty-first day she left the hospital "feeling better than for years." Seven months later she felt free from depression, her skin was clear, her color pink. She felt perfectly well in every way. Attacks came at irregular, longer intervals, were never severe and were not followed by gastric disturbance or depression. Appetite is good; digestion is perfect, with larger quantity and variety of food than was ever before possible. Nine months after operation a barium series showed marked improvement in stomach, duodenum, cæcum and ascending colon. Not quite three years after operation she developed distress in upper abdomen; fluoroscopy showed stomach, first and second portion of duodenum in good position and freely movable; dependent duodenum (third and end of second portions) was dilated and there was evidence of obstruction at the duodeno-jejunal angle.

Operation: By another surgeon: 6-9-1921. Incision: vertical right rectus near median line. Findings: Stomach: normal. Pylorus and duodenum suspended from anterior edge of liver by flexible adhesions about 3 cm. long, allowing free mobility without kinking or obstruction. Adhesions were present between omentum and scars. No constriction of colon. Procedure: Adhesions divided. Duodeno-jejunostomy. Later information lacking. Result for two years, nine months. Perfect relief of digestive troubles.

(Examination of the original barium series shows some dilation of dependent duodenum, but at that time its significance was not generally appreciated, as it is at the present time.)

Case XLIV, E. B. S., F. Fifty-one years. Always frail. At twelve years jaundice with much digestive distress for several weeks. Then comparatively

well until twenty-one years, since when she has had much digestive trouble, distress and a "sense of dragging" in the upper abdomen, belching of gas, no nausea or vomiting; frequent flatulence; moderate constipation; very fickle appetite. At first these troubles came in attacks lasting for several weeks, followed by comparative relief for a few months. Gradually these attacks have become more frequent, more persistent and more severe, the distress being most in the right upper quadrant. No jaundice, no vomiting. Sense of dragging in epigastrium constant without relation to food. In last two years loss of twelve pounds, and great depreciation in strength. Very nervous. Occasional sharp headaches. Heart irregular with attacks. Almost completely disabled. No urinary disturbances. Periods began at twelve, irregular, profuse, some pain; ceased at forty-eight.

P. Ex.: Tall, slender, sallow. Skin dry and flabby. Pulse 80, regular, fair quality. Hæmoglobin, 90 per cent.; R. C., 3,190,000; B. P., 135 mm. Rough mitral systolic murmur, no decompensation. Lungs, urine, etc., negative. Abdomen: distended with gas, very tympanitic except for dull note over gall-bladder, which seems to be distended, palpable and slightly tender. Elsewhere no tenderness.

X-ray series: Stomach: marked fish-hook type; descending into true pelvis; seven-hour retention. Duodenum: apex at level of lumbar iv in erect posture; one-half vertebra higher in prone posture (fixation). No deformity suggestive of ulcer. Duodeno-jejunal angle is at level of lumbar iii, *i.e.*, higher than apex. It is not tender and shows no obstruction. Liver shadow is unusually low, accounting for low fixation of duodenal apex. No indication of gall-stones. Cæcum inverted; and appendix, beneath liver, is segmented and tender to pressure. Some stasis in cæcum and ascending colon. Pre-operative Diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 2-3-1919. Incision: T. R. R. just above navel. Findings: Right edge of liver just below right iliac crest. Liver and gall-bladder normal except for position; also membrane. Hepatic flexure held in contact with fundus of gall-bladder by membrane. Inverted cæcum and appendix to outer side of gall-bladder just beneath right lobe of liver, but not adherent to it, being held up by peritoneal folds fusing with peritoneum in front of right kidney. Ileocæcal valve on postero-external aspect of inverted cæcum. Pylorus and first portion of duodenum held in direct contact with gall-bladder and cystic duct by hepato-duodenal membrane which caused fixation, compression and angulation. Stomach: enlarged but showed no sign of intrinsic disease. Duodeno-jejunal angle: normal. Kidneys: normal except for increased mobility. Uterus: small. Ovaries: small and fibrotic. Procedure: Appendectomy. Mobilization of cæcum and terminal ileum to their normal site. Division of hepato-duodeno-colic membrane with mobilization of hepatic flexure; and duodenum downward 6 cm. Raw surfaces covered in. Convalescence: Uneventful.

Result: Two years, ten months: Some flatulence, occasional constipation, fine appetite; very few restrictions as to food; much improved in color; and very greatly in strength. Much improved, two years, ten months. (Practically cured.)

(Her brother-in-law states that "she is entirely made over, she was always sick, self-centred and a nuisance to everybody. She is now well, attending to her own duties, and very helpful to all those about her." She ought properly to be classed as a cure in spite of her occasional digestive discomforts.)

Case XLVII, J. F., M. Forty years. Frequent bilious attacks as a boy. Then well as to digestion until after twenty-eighth year when he had typhoid and relapse, causing thirteen weeks' stay in bed. Since the typhoid there have been digestive disturbances, usually in long attacks with occasional short intervals

of relief. At first the difficulty was chiefly from gas distention with only moderate pain and no constipation, and no nausea. There has been marked increase in the disturbance, especially during the last eight months, preceding operation, and increasing constipation, occasional nausea, more pain, occasional headaches, and a marked loss of energy and capacity, both mental and physical, have been added to the clinical picture. Extreme nervousness, irritability and loss of self-control have developed. He is a moderate user of tobacco and alcohol.

P. Ex.: He is a large framed, well-nourished man of good color. Heart, lungs, urine, gastric contents and stool showed nothing of moment. Abdomen: somewhat distended; tympanitic over cæcum, ascending colon and beginning transverse colon; almost flat to percussion on the left side; moderate tenderness beneath right ninth and tenth costal cartilages, and over the appendix. Otherwise negative.

X-ray series: Stomach: smaller than average; shows no sign of ulcer; peristalsis hypertonic. Duodenum: apex, erect posture, at lumbar ii, prone posture one-half vertebra higher; immovable during fluoroscopy. Terminal ileum curled upon itself behind cæcum. Appendix: visualized clearly; freely movable. Cæcum and colon: no stasis. Gall-bladder and urinary apparatus showed no calculi. Pre-operative diagnosis: Hepato-duodenal membrane. Chronic appendicitis.

Operation: 3-3-1919. Incision: T. R. R. Two cm. above navel. Findings: Stomach: smaller than normal, cow-horn type; walls somewhat hypertrophied; antrum to right of median line and curved sharply back, up and inward to. Duodenum: apex, fixed rigidly 1 cm. below cystic duct, kinked and compressed; by hepato-duodenal membrane running from proximal third of gall-bladder and cystic duct to first portion of duodenum, involving apex and running across in front, membrane rigid. Gall-bladder normal except for membrane. Liver normal except for thickened capsule on under surface right lobe. Duodeno-jejunal angle, transverse and descending colons, normal. Terminal ileum freely movable. Appendix: long, irregular; tip fibrous for 3 cm. Kidneys and pelvic contents negative. Procedure: Hepato-duodenal membrane divided. Duodenum mobilized downward 4 cm. Appendix: removed, stump inverted. Post-operative period was stormy; temperature was around 103 for the first four days; there was marked abdominal distention from the start, which was very refractory to treatment for seventy-two hours, but then diminished considerably; pulse, 130; respiration, 26; râles at right base. On the third day there was flatness up to the sixth rib posteriorly. After the fifth day the temperature descended gradually to 101; flatulence much less, pulse and respiration much less embarrassed. Tenth day sutures removed; wound free from tenderness or swelling; apparently perfect primary union. Fourteenth day: discharge from outer angle of wound; culture showed colon bacillus. Eighteenth day: temperature again 103.6 and X-ray picture indicated subphrenic abscess, which was evacuated by another surgeon, a quart of yellow, almost transparent fluid being obtained, followed by turbid fluid; culture showed colon bacillus. Convalescence: was then steady and he left the hospital on the thirty-eighth day after operation, his digestive disturbances having disappeared. Pathological report: "Atrophic appendix."

Result: Failure. Still troubled with flatulence, constipation, etc. Failure, two years, nine months.

Case IV, T. S., M. Thirty-five years old. Absolutely well until twenty-three years old. After eating heartily he went hunting, exercised strenuously, felt epigastric pain, distention and "splashing in stomach." Thereafter, food or drinks caused same trouble, but in increasing degree. For a long time ingestion of fluids caused protrusion of epigastrium, downward dragging, headache, and tremulous weakness. Anorexia. Eats only

two small meals per day from fear of the pain. No vomiting. Always had marked flatulence. No definite constipation. Pain is somewhat relieved by bending forward and pressing against abdomen; also by lying on left side; lying on right side causes pain. He is incapacitated about fifty per cent.

P. Ex.: Small frame, thin, but fairly muscular Japanese. Facies of constant suffering. Lungs, heart, urine: negative. Abdomen: much distended and tympanitic. Stomach: dilated; down to navel; very tympanitic; splashing marked; tender just above navel and increasing upward to mid-epigastrium. Cæcum and ascending colon are distended, tympanitic and tender. Appendix: no localized tenderness.

X-ray series: Omitted for financial reasons. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Appendicitis—chronic(?).

Operation: 7-15-1916. Incision: T. R. R. 4 cm. above navel. Findings: Hepato-duodeno-colic membrane, short and thick, and with an extension to quadrate lobe of liver. Duodenum: fixed high; kinked; compressed. Stomach: greatly enlarged, distended, well into right flank; doubled back on itself to reach duodenal fixation. No intrinsic gastric disease. Duodeno-jejunal angle: negative. Pericolic membrane: well developed, covering whole cæcum and ascending colon, causing compression, kinking, etc. Cæcum: dilated. Appendix: very long; irregular calibre; external to cæcum. Procedure: Hepato-duodeno-colic membrane divided; duodenum mobilized downward 7 cm. Pericolic membrane divided. Appendix removed. Convalescence: Uneventful. Pathological report: Chronic appendicitis.

Result: Four months later had gained 15 pounds, felt much better and able to work well. Nineteen months later—appetite good, could eat three meals per day; all foods; no pain; slight flatulence; no constipation. Much improved, nineteen months.

Case V, B. C., F. Thirty-three years. Never robust. Weak lungs, chills and fever at fourteen years. For many years subject to cramps and diarrhœa, with increasing depreciation in general health. From twenty-five years of age has spent nearly half her time in bed at various sanatoria, with temporary improvement especially in weight. When twenty-seven years of age, appendix was sought but not found. A retroperitoneal gland was removed which was said to be tubercular. At thirty years of age began to have attacks of unconsciousness followed by severe pain, nausea, and great weakness, which have become gradually more frequent, with much abdominal pain and alternating constipation and diarrhœa between times. No stamina. One hundred per cent. disability. Sense of downward dragging in epigastrium constant; somewhat relieved by crouching forward.

P. Ex.: Just after three months at sanatorium. Small frame; fairly nourished; good color. Heart, lungs and urine: negative. Blood: Hæmoglobin 100 per cent.; R. C., 6,187,000. Pressure, 124/84. Stomach: 100 c.c. retention, three hours after 200 c.c. meal. Achlorhydria. Stool: negative. Abdomen: small appendix scar. Tenderness over cæcum which is distended and tympanitic. Stomach: dilated; tympanitic; tenderness to right of mid-epigastrium.

X-ray series: Stomach: fish-hook; much dilated; down to true pelvis; atonic peristalsis. Duodenum: apex fixed high; sharply angulated; cap distorted. Cæcum: dilated; prolapsed into pelvis. Ileac stasis. Hepatic flexure fixed high near angulated duodenum. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane.

Operation: 10-20-1916. Incision: T. R. R. Four cm. above navel. Findings: Hepato-duodeno-colic membrane, short and rigid, holding duodenal apex fast, causing kinking and compression. Stomach: much dilated; thin walled; over in right side, bent back on itself to reach fixed duodenum. Liver: normal; gall-

bladder: normal, except for membrane. Omentum: firmly adherent to scar of appendix operation. Pericolic membrane: kinking and compressing cæcum and ascending colon, especially at hepatic flexure. Appendix: small; retrocæcal for 3 cm.; free for 1.5 cm. of tip. No signs of tubercular infection of peritoneum, of intrinsic disease of stomach or intestine, or of pelvic organs. Procedure: Division of hepato-duodeno-colic membrane with mobilization of duodenum downward 6 cm. Appendectomy. Division of pericolic membrane. Convalescence: Uneventful. The day after operation she stated the "sense of dragging" in the epigastrium was gone for the first time in years.

Result: No digestive disturbance, unless greatly fatigued; no restriction in diet. Gained fifteen pounds. Color good. Strength and endurance normal. Does all kinds of household and social duties continuously. Cured, five years, two months.

Case VI, F. M., M. Fifty years. For over thirty years accustomed to sudden attacks of severe abdominal cramps with nausea and vomiting and temporary total disability, coming at irregular intervals, and having no apparent relation to meals.

There was no indigestion between attacks, the appetite was good and the bowels regular and he was well nourished. When forty-nine years old an attack took the form of typical biliary colic, but was not followed by jaundice or fever. A selected, restricted diet reduced his weight 40 pounds, and almost eliminated the attacks during the next eleven months. During the following month he had two severe attacks and felt weak and miserable all the time. During the last ten days pain and tenderness developed in the right hypochondrium and over the lower ribs, aggravated by deep breathing or using the right arm. Constipation has gradually developed, as has a sense of depression and lassitude. Ordinarily he is a most energetic, persistent worker. The heart shows considerable irregularity when tobacco is used. He has had a chronic cough for several years.

P. Ex.: A man of large size, well nourished, worried and pale. Lungs: chronic bronchitis; no pleuritic friction sounds. Heart: no enlargement; slight systolic murmur at apex. Pulse: regular, 72, and good quality. Urine: normal. Abdomen: prominent; wall fat; marked tenderness over right hypochondrium and lower ribs, also hyperæsthesia. Deep breathing prevented. Tenderness about one-third from the xiphoid to navel. No tenderness over appendix or cæcum. Gall-bladder could not be felt.

X-ray series: Stomach of moderate size, cow-horn shape; marked peristalsis; no retention; no sign of ulcer. Duodenum: cap round with hazy outline; apex fixed high, well to the right and immobile. Gall-bladder: shadow seemed enlarged and contained two shadows suspicious of stones. Hepatic flexure: held high, fixed and angulated. Cæcum and first half of ascending colon greatly dilated. Ileac stasis. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Biliary calculi.

Operation: 11-9-1916. Incision: T. R. R. Three cm. above navel. Findings: Gall-bladder seemed normal in every way and contained no stones. No stones in common duct to be felt. Pancreas: normal to palpation. Liver: normal. Stomach: not large; wall thicker than normal, but otherwise negative. Hepato-duodeno-colic membrane: from the cystic duct and neighboring liver ran to pylorus and duodenum, fixing them firmly against liver and duct, and then down and outward to hepatic flexure. It contained many vertical white threads, was inelastic, held the apex of duodenum high and well back, and caused kinking and compression. This membrane surrounded the cystic duct so that pulling downward on the duodenum caused torsion and angulation of the cystic duct, possibly accounting for the apparent attacks of biliary colic. Pericolic membrane: covered cæcum and ascending colon with thickened bands crossing the middle of ascending

colon and the hepatic flexure. Cæcum considerably dilated. Ileum: negative. Appendix: about 15 cm. long, 1 cm. in diameter; much congested; filled with soft fæces. Procedure: Mobilization of duodenum 10 cm. downward and forward, freeing cystic duct of the traction. Appendectomy. Division of pericolic membrane and bands, freeing colon. Pathological report: Catarrhal appendicitis. Convalescence: For five days persistent hiccough, nausea and regurgitation. Abdomen soft, not tender; bowel expelling flatus. Thereafter improved steadily. Ninth day inner end of wound discharged about 6 ounces of liquefied purulent fat. Infection cleared up in five days by irrigations with Dakin's solution, and healing complete about two weeks later. For three weeks following operation he had some of the old spasms of pain, but they were much less severe and often would be aborted, which had never previously occurred. They gradually faded away. Seven weeks after operation he had gained 12 pounds, looked and felt well, the wound was solid, and he had no pain for three weeks. Three months after operation, subsequent to aggravation of his chronic cough, he developed a hernia, the ends of the rectus being separated 5 cm. On May 30, 1917, under two per cent. novocaine, the hernia was repaired, and has remained solid.

Result: Five years, three months. Some pain; apt to follow high carbohydrate diet. Moderate flatulence and constipation. Appetite excellent; carbohydrate restriction necessary. Color much improved. Capacity for work greatly increased. Much improved, five years, three months.

Case VII, M. W., F. Fifty-three years. When twenty-three years old had very severe attacks of sick headache, vomiting, photophobia, constipation, etc. Correction of refraction gave some relief. Since thirty-eight years old has had constant distress after eating, a sense of dragging and distention rather than actual pain, followed by sour eructations, headache, and lassitude, mental and physical. Tires very easily. Constipation very troublesome, stools scybalous. The troubles have gradually increased. Menopause at forty-eight; no special disturbance. Dyspnœa on exertion.

P. Ex.: She is a short, over-fat, flabby woman of good color. Marked pyorrhœa with recession of gums. Finger joints enlarged. Heart, lungs, urine: negative. Pulse 72. Abdomen: prominent, fat, tympanitic, showing marked tenderness over the appendix, and slight tenderness in the mid-epigastrium and over the sigmoid.

X-ray series: Stomach: fish-hook type, enlarged; extending to right of median line; showing twelve-hour retention; no evidence of ulcer. Duodenum: apex fixed high and angulated; cap distorted and irregular. Colonic and iliac stasis after seventy-two hours with barium still in appendix. Gall-bladder shows small round shadow, suspicious of stone. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 11-21-16. Incision: T. R. R. Three cm. above navel. Findings: Hepato-duodenal membrane running from near the fundus of gall-bladder to lower border of duodneum near pylorus, which was held firmly against gall-bladder, thus suffering axial rotation as well as high fixation. Duodenum then ran along gall-bladder to cystic duct, being firmly held by membrane. Gall-bladder: normal in every way except for membrane. Liver: normal. Stomach: much dilated; well over into right flank; bent backward and inward to gall-bladder. No intrinsic disease. Pericolic membrane: a firm, broad band ran upward and inward across middle of ascending colon causing marked compression. Cæcum: dilated and somewhat thinned. Appendix: long, distended and much congested. Pelvic organs: infantile; ovaries, fibrotic. Procedure: Hepato-duodeno membrane divided and duodenum mobilized downward 10 cm. Pericolic membrane divided and colon freed. Appendix: removed; stump in-

verted. Convalescence: Uneventful. One week after operation the bowels moved spontaneously for the first time in years.

Result: No pain; occasional constipation and flatulence. Appetite is good. Restrictions as to apples, cabbage-family, and cooked cheese. Very great improvement in general health and capacity to work. Much improved, two years, eight months.

Case VIII, A. G., F. Twenty-four years. Always frail, and always suffered from indigestion. When nineteen years old the appendix was removed in the hope of relieving the indigestion. After temporary improvement she began to have attacks of cramping pains, nausea and diarrhœa. From twenty-three and one-half years on, the attacks became much more frequent and severe, and were asscoiated with marked distention and tenderness of the cæcal region. Free catharsis causes some relief for one or two days. She was totally incapacitated.

P. Ex.: She is of small size; brunette; well nourished, with marked overgrowth of hair generally; with enlarged thyroid but with no rapid pulse or exophthalmos. Extremely nervous; muscles all undergo tonic spasm on palpation. Heart: systolic murmur over left second space. Lungs: negative. Respiration: thoracic in type. Abdomen: Right, oblique, appendix scar. Cæcum: distended and very tender, dull to percussion. Remaining colon, tender, tympanitic. Gastric contents: negative.

X-ray series: Thought inadvisable, because of the nervous general condition and the marked abdominal disturbances. Pre-operative diagnosis: Pericolic membrane constricting colon.

Operation: 2-20-17. Incision: Vertical R. R., mostly above navel. Findings: Omental adhesions to appendix scar and to inner side of colon just above ileum, causing rotation of colon forward and outward. Pericolic membrane covered entire ascending colon, its upper edge was much thickened and caused compression, kinking and marked obstruction near hepatic flexure. Hepato-duodenal membrane of moderate size from proximal gall-bladder to first part of duodenum. Gall-bladder normal except for membrane. Liver: small and thin (patient also quite small). Stomach: normal. Ilium: normal. Cæcum: not flabby or dilated. Pelvic organs: normal. Procedure: Omental adhesions separated from appendix scar and colon. Damaged omentum resected and raw stump inverted. Pericolic membrane divided and colon mobilized. Hepato-duodenal membrane: divided and duodenum mobilized downward 2 to 3 cm. (This membrane was not causing very obvious disturbance but was divided on general principles.) Convalescence: Uneventful. The old attacks disappeared.

Result: Two years, five months, no pain; no flatulence; good appetite; no dietary restrictions; has gained weight; improved in complexion. Completely recovered health and endurance. Cured, two years, five months.

Case IX, W. F. R., M. Fifty-five years. Always perfectly well until forty-nine years old, when accident caused loss of left upper extremity and persistent pain in left brachial plexus; this pain has persisted in spite of root section. When fifty-three years old began to have severe pain and great bloating after eating. This trouble increased so much that he ate only tea and toast from fear of the pain. Constipation became very aggravated. During the two months preceding operation he lost fifteen pounds, although he had been very thin for years.

P. Ex.: He is emaciated, pale and haggard. Heart and lungs: negative. Gastric contents: negative as to chemistry and blood. Stools: negative to blood. Abdomen: distended, tympanitic, especially over the cæcum, no tender areas anywhere.

X-ray series: Stomach: dilated, fish-hook type, atonic, six-hour retention, no ulcer. Duodenum: high fixation; angulation at apex; cap not deformed; no ulcer. Cæcum and first half of ascending colon dilated but above that to

well beyond hepatic flexure colon appeared constricted and twisted. Appendix: not visualized. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane.

Operation: 3-19-17. Incision: T. R. R. just above navel. Findings: Stomach: greatly dilated, distended, reaching over to right flank and bending backward, inward and upward to duodenum. No evidence of ulcer. Duodenum: apex adherent to under surface of liver to left of cystic duct. Hepato-duodenal membrane: from cystic duct and proximal gall-bladder to apex of duodenum, down duodenum to pylorus, greater curvature and so on, to transverse colon, which was firmly bound to stomach for 3 cm. Liver and gall-bladder: normal except for membrane. Pericolic membrane: Broad, firm band (4 cm. wide) ran downward and inward across middle of ascending colon, kinking and compressing and twisting it. Appendix: shrivelled and adherent throughout. Procedure: Duodenum mobilized downward 6 cm. Pericolic membrane divided and colon mobilized. Appendix: removed, stump inverted. Pathological report: Chronic catarrhal appendicitis. Convalescence: Uncomfortable. Wound broke down on fifth day and healing was not complete until thirty-fourth day. For first few days there was much flatulence and pain, but these yielded and soon his digestion was comfortable and his constipation almost disappeared.

Result: Two years, ten months. No pain; some gas; slight constipation; appetite good; no restrictions. General health and strength much better. Much improved, two years, ten months.

Case XIII, A. V. P., F. Twenty-five years. For many years she has been subject to attacks of headache, nausea, vomiting and abdominal pain. Between attacks there is always discomfort, flatulence and constipation. The discomfort is chiefly in the right side. The attacks increase in frequency and severity, and are likely to be precipitated by indiscretions in diet. They cause a certain amount of apprehension and disability. In other respects she is very well.

P. Ex.: She is of small frame, quite fat, and of good color. Heart and lungs: negative. Blood: Hæmoglobin, 100 per cent.; red blood-cells, 5,280,000. Abdomen: distended and tympanitic, especially on the right side. Tenderness along the entire colon, but especially along the ascending colon. Localized tenderness over the appendix area and just to the right of mid-epigastrium.

X-ray series: Taken three years before above examination. Showed "disturbances about the cæcum, but nothing wrong with stomach or pylorus." Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 8-4-17. Incision: Vertical R. R. Findings: Stomach: somewhat dilated; fish-hook; no ulcer. Duodenum: apex fixed high; kinked, compressed by. Hepato-duodenal membrane: extending half way to fundus of gall-bladder, running to first portion of duodenum. Liver and gall-bladder: normal. Pericolic membrane: about 7 cm. broad, running downward and inward across middle of ascending colon and clamping it back against body wall, causing much obstruction. Cæcum: somewhat dilated; rolled forward and upward over the lower edge of pericolic membrane. Appendix: 5 cm. long and about 2 mm. thick, bound to cæcum. Hepatic flexure: fell forward and downward over the upper edge of pericolic membrane, causing a double twist-kink of the gut. Pelvic organs: quite small, but otherwise normal. Procedure: Mobilization of duodenum downward 7 cm. Mobilization of ascending colon. Appendectomy. Pathological report: Chronic oblit. appendicitis.

Result: Complete cure. Cured, four years, four months.

Case XV, E. H. W., F. Forty-two years. All her life she had been subject to epigastric pain and digestive discomfort. Chorea and endocarditis as child.

When twenty years old had an attack of severe pain in right lower quadrant, lasting nearly a week. These have recurred about twice a year since. When thirty-three, heart lesion became serious and has given much trouble since. When forty the digestive attacks became much more frequent and severe and the cæcal region would balloon up. She developed definite colitis with alternating constipation and diarrhœa. Her diet became very restricted, she lost weight and became totally incapacitated. She has always felt a dragging sensation in upper abdomen.

P. Ex.: She is of small frame, fairly nourished, pale and haggard. Very neurotic but optimistic. Lungs: negative. Heart: mitral, systolic, lesion; poorly compensated. Urine: gastric contents; stools: negative, except for mucus in stools. Abdomen: somewhat distended and tympanitic. Tenderness along entire colon, but marked and localized over appendix and to the right of mid-epigastrium. Stomach: seems enlarged downward and to right.

X-ray series: Stomach: fish-hook; no retention. Duodenum: apex high, angulated; deformity of cap but not indicative of ulcer. Cæcum: dilated. Hepatic flexure: fixed high and sharply angulated. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis. Colitis.

Operation: 10-10-17. Incision: T. R. R. just above navel. Findings: Stomach: negative. Hepato-duodenal membrane: out to middle of gall-bladder and down to pylorus and doudenum which were held within 5 cm. of gall-bladder. Gall-bladder and liver: normal. Cæcum: dilated. Appendix: long, large, angulated, retrocæcal. Pericolic membrane: one band fixing hepatic flexure high and angulating it; one band across middle of ascending colon, constricting it. Procedure: Mobilization duodenum downward 7 cm. Mobilization colon and hepatic flexure. Appendectomy. Convalescence: Uneventful. On the first day she states the old dragging sensation was gone from the epigastric region.

Result: Because of the serious heart lesion her general health has been very variable. Four years and two months after operation she had none of her old pains; no flatulence; no constipation or diarrhœa; good appetite and a few restrictions of diet. Color is better, and general health improved. Improved, four years, two months.

Case XVI, H. J., F. Twenty-four years. She has always had frequent digestive disturbance accompanied by marked constipation since childhood. She was otherwise well. When nineteen she had an attack of severe pain, distention and constipation. There was some tenderness in the right lower quadrant. Appendix was removed. Since operation pains have been much more frequent, much more severe. The stubborn constipation has developed, sometimes alternating with mucus diarrhœa. Her general condition has depreciated more and more until she has become a chronic invalid, almost completely disabled. During the later attacks food has caused pain and nausea so the diet has become extremely limited. When lying down she is comparatively comfortable, but the erect posture always induces pain. During the last year she has lost 25 pounds in weight and has marked loss of stamina. She has frequent headaches.

P. Ex.: She is tall, rather slender, of fair color. Skin is flabby, dry and somewhat parchment-like. Heart and lungs, urine, gastric contents and stool: negative. Abdomen: distended, especially on the right side. Cæcum: distended; quite tender to pressure and can be made to roll and gurgle under the fingers. Tenderness: extends upward to about level of navel. There is also tenderness in the mid-epigastrium and over the sigmoid which is also distended. On percussion the right iliac fossa and up to the edge of the tender area there is flatness. Elsewhere the abdomen is tympanitic. Stomach: seems enlarged.

X-ray series: Reported to have shown high fixation of apex of duodenum. Stomach: somewhat enlarged; fish-hook type. Transverse colon: marked ptosis, and apparently much longer, as a whole, than the average. Hepatic flexure:

fixed and angulated. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Adhesions.

Operation: 11-22-17. Incision: T. R. R. Just above navel. Findings: Stomach: was much enlarged, projected way over to right flank; turned backward, inward and upward to apex of duodenum. Pylorus and first part of duodenum lay in contact with gall-bladder from fundus to cystic duct and was held in close contact by typical, hepato-duodenal membrane: running from middle of gall-bladder to cystic duct. Except for the membrane the stomach, pylorus, duodenum, gall-bladder and liver were normal. Cæcum: was much dilated, rather thin and pale. It was not adherent to the old appendix scar. There was one adhesion between the omentum and the old scar. Pericolic membrane: involved the ascending colon from the hepatic flexure, which was kinked and compressed, down to the lower part of the ascending colon somewhat above the cæcum. A thick transverse band crossed the middle of the ascending colon, compressed it tightly and kinked it strongly. Pelvic organs: normal in every respect. Descending colon and sigmoid: normal. Procedure: Mobilization of duodenum and pylorus downward about 5 cm. Omental adhesion separated. Pericolic membrane divided and colon mobilized. Convalescence: For the first thirty-six hours there was considerable nausea and vomiting. Headache followed for two days afterward. Considerable abdominal pain for first five days. After the five days she was comfortable except for occasional attacks of griping pain, which were relieved by belladonna. There was stubborn constipation in spite of irrigations or cathartics. Temperature for first few days became subnormal; remained almost constantly at 96.2, with pulse varying between 56 and 60. She feels tired out constantly. Has no real appetite. Wound healed by primary union.

Result: Four years, one month. Much improved. Has occasional abdominal pain but never severe. Occasional flatulence. Constipation is still present. Appetite variable but can eat a greater variety than before. Has gained a few pounds in weight. Much improved in color. General health is much improved. Rarely has headache. Since operation she had had influenza and two children and in spite of that has shown marked improvement. Much improved, four years, one month.

Case XVII, W. T. J., M. Twenty-seven years. He was perfectly well in every way until twenty-six years old when he developed a nervous breakdown. He was beginning to get in shape when he had two successive attacks of influenza in January, 1917. His neurasthenia recurred. In the fall when much improved he had entered a training camp, but the strenuous life soon caused another breakdown and he was discharged from the service. He has had no pain in the abdomen, but for over a year has had much flatulence and a sense of heaviness and dragging after eating. The bowels have been regular without drugs.

P. Ex.: He is tall, slender, dark complexion, looks slightly pale and depressed. He is very nervous and hysterical. Heart, lungs, gastric contents and stool: negative. Urine: negative, except for a faint trace of albumin. Blood-pressure: 144 mm. Abdomen: Normal in contour and not much distended. There is normal tympany. There is very definite localized tenderness in the appendix region. Moderate tenderness in the mid-epigastrium.

X-ray series: Stomach: slightly enlarged; fish-hook type; projects well to the right of median line and seems fixed. Peristalsis is vigorous, and stomach was empty in three hours. Apex of duodenum is fixed high and is angulated. Cæcum: conical in shape and is in the true pelvis. Hepatic flexure: somewhat high and angulated. No sign of ulcer of stomach or duodenum, or of gall-stones. Appendix: not visualized. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 11-27-17. Incision: T. R. R. Two cm. above navel. Findings: Stomach: enlarged; well over to the right, backward, upward and inward to duodenum. Apex and first part of duodenum: fixed high, kinked and compressed. Otherwise, stomach, pylorus and duodenum were negative. Hepato-duodenal membrane: about 4 cm. wide, from gall-bladder and cystic duct to first portion and apex of duodenum, allowing only 1 cm. mobility. Pericolic membrane: along most of the ascending colon with thickened mid-portion running across middle of ascending colon. It constricted the gut and kinked it definitely. Cæcum: moderately dilated. Appendix: quite irregular in calibre, about 8 cm. long. It was not adherent. Procedure: Mobilization of duodenum downward 5 cm. Mobilization of ascending colon by division of pericolic membrane. Appendectomy. Convalescence: Uneventful. Free from pain, nausea or any disturbance. Recovery of strength, weight, color and nervous energy. Mental balance very rapidly recovered.

Result: Four years. Absolutely well in every way. Has no digestive disturbance of any kind. Gained thirty pounds in weight with much improvement in color. He states that his general health and capacity for work have increased "1000 per cent." He also states that his whole mental attitude is now normal and steady. Cured, four years.

Case XVIII, M. N., F. Thirty-nine years. As a child she was subject to attacks of pain in the right lower quadrant. She had occasional constipation and a fickle appetite. She has had two children and perineorrhaphy following the second one. Since a definite attack when she was thirty-four years old there have been frequent repetitions. Often the pain lasts for only ten or fifteen minutes, but the side would be sensitive to pressure and the pain would recur during a week or so whenever she walked or exercised. She has had frequent headaches and there has been marked loss of general health and strength as well as in weight. Her physician reported that she had developed definite phychosis during her thirty-ninth year. She is likely to do things very vigorously and persistently for a few days and then go to pieces for one or two weeks.

P. Ex.: She is tall, sallow, weighs only 110 pounds. She is nervous, irritable, liable to obsessions; very energetic up to a point of exhaustion. Heart, lungs, urine: negative. Abdomen: flat; scaphoid and wall seems devoid of fat but muscles are well developed. Stomach: somewhat enlarged and tympanitic. Distinct tenderness localized in appendix area. Cæcum: dilated and gurgles with gas whenever compressed. Tenderness: just below the ninth costal cartilage, right side. Bimanual examination of the pelvis showed nothing.

X-ray series: Omitted for various reasons. Pre-operative diagnosis: Chronic appendicitis. Jackson's membrane.

Operation: 12-4-17. Incision: T. R. R. Two cm. above navel. Findings: Stomach: Freely movable; greatly distended with gas, well over into the right side. Duodenum: apex adherent to cystic duct and proximal gall-bladder (hepato-duodenal membrane), and in addition by some very firm, thick adhesions to the under surface of liver 2 cm. to the right of gall-bladder. No ulcer could be made out in either the duodenum or stomach. Gall-bladder and liver: normal otherwise. Right kidney: normal, but more freely movable than usual. Cæcum: free, somewhat dilated. Appendix: thickened, retrocæcal. Pericolic membrane: involved ascending colon from just above the cæcum to the hepatic flexure which was kinked and compressed by a strong, short band. Pelvic organs: uterus anteverted, freely movable. Right ovary: very fibrous and showed a hard, nodular growth at the hilus. Left ovary was a single cyst. Procedure: Mobilization of duodenum downward 4 cm. Mobilization of ascending colon and hepatic flexure. Appendectomy. Oöphorectomy through Pfannenstiel incision. Convalescence; Perfectly uneventful.

Result: Four years. Occasional abdominal pain, never severe. Some flatulence; no constipation. Appetite, variable. No restriction of diet. Has gained sixteen pounds in weight. Color much improved. Capacity for work has "enormously" improved. In addition, psychosis and nervous instability have disappeared. She is now a perfectly normal woman. Much improved, four years.

Case XX, D. C., F. Twenty-three years. She had had so-called nervous indigestion at various periods in her life. Tonsils were removed at seventeen years because of repeated attacks of rheumatic pain. These rheumatic pains were attributed to some focus of infection, but examinations of the various nasal sinuses, teeth and throat show no focus. Appendix had been removed several years ago. The only thing left to lodge infection was, therefore, the gastro-intestinal tract and her history was not very conclusive. There had been various disturbances of digestion associated with flatulence, constipation and a variable appetite.

P. Ex.: She is a young woman of medium height, very well nourished, good color. Heart, lungs, mouth, throat, teeth, urine, gastric contents, stool: negative. Abdomen: appears normal. There is moderate distention with gas. Marked tenderness on the inner side of her short, oblique appendix scar. Marked tenderness in about the middle of ascending colon. Also localized tenderness in the mid-epigastrium. Otherwise abdominal examination is negative.

X-ray series: Stomach: considerably enlarged, much ptosed, fish-hook type. Peristaltic waves were atonic. Marked retention after eight and one-half hours, and for the first three hours almost none of the barium was discharged. Duodenum: first portion much enlarged but without other deformity. It is fixed in a high position. Cæcum: dilated. Some stasis in ileum and cæcum. Appendix: not visualized. Transverse colon: elongated and ptosed. There is evidence of constriction in the hepatic flexure, which is, however, only slightly above the iliac crest. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane.

Operation: 1-30-18. Incision: T. R. R. Findings: Stomach: greatly enlarged; pushed over to right and then bent backward, inward and upward. Walls were somewhat thinner than normal. Duodenum: apex was fixed high by short and very thick free edge of lesser omentum which extended slightly onto proximal end of gall-bladder. This membrane was very vascular. Also there was an extension which passed across the front of first portion of duodenum to hepatic flexure which it helped to suspend and kink. Liver and gall-bladder: normal. Cæcum: much dilated. It was somewhat adherent posteriorly to iliac fossa. Pericolic membrane: covered cæcum and ascending colon. One thickened band passed across the colon just above cæcum and the second one passed transversely across the ascending colon just below the hepatic flexure and ran to beginning transverse colon so as to sharply angulate the hepatic flexure, also both limbs of gut just below the hepatic flexure. Kidneys and pelvic organs: normal. Procedure: Mobilization duodenum downward 4 cm. Mobilization cæcum, ascending colon and hepatic flexure. Convalescence: Uneventful.

Result: Occasional abdominal pain but of a different kind, troubled with flatulence; some constipation; appetite very good. No restriction of diet. Gained ten pounds in weight. Improved in color. Her general strength is much better. Some little time after operation she had much pain in the back and it was found that there was some disturbance of dorsal xi and xii of probably tubercular type. For this she has been wearing a brace, and it is still causing some disturbance. Much improved, eighteen months.

Case XXII, E. S. W., M. Fifty-five years. Always perfectly well until fifty-three and one-half years old. At that time he had an attack of vertigo with nausea, vomiting, violent diarrhœa and some temperature. Absolutely no

further trouble until fifty-five years old. On February 8, 1918, he awoke in the morning with a dull, aching pain in the epigastrium. No nausea or diarrhœa; after two hours the pain ceased, but he was exhausted for three days. Nine days later he walked three miles in the cold and ate a hearty dinner. Awoke at one o'clock in the morning with pain, which grew steadily worse until he was given a hypodermic. The next morning temperature was 104. Thirty-six hours after the onset there was distinct jaundice both of the skin and conjunctiva. There was very marked prostration. He has never had any constipation and says he has never had indigestion. His family doctor states that he is always troubled with some flatulence and discomfort because he leads a very sedentary life and is inclined to over-eat.

P. Ex.: Large man, well nourished, fair color, but slightly icteric. Teeth: good condition, but there is some recession of the gums. Heart, lungs: normal. There is marked accentuation of the aortic second sound. Blood-pressure, 188/114. Urine: shows faint trace of albumin, considerable bile coloring and hyaline casts. Abdomen: prominent; quite fat; no tenderness can be made out anywhere. Just below the ninth and tenth costal cartilage it seems distended. Gall-bladder can be felt; also percussion shows dullness and flatness in the same area. Edge of the liver could not be made out. Appendix: no tenderness. Blood examination: negative.

X-ray series: In gall-bladder region shows shadow the size of a large egg. Shows no shadow of stone or stones. Pre-operative diagnosis: Cholecystitis with biliary calculi.

Operation: 3-16-18. Incision: T. R. R. Three cm. above navel. Findings: Stomach: enlarged, crowded well over to right of median line, passed upward, backward and inward to duodenum. Duodenum: apex held high and kinked by membrane. Gall-bladder: somewhat distended, tense and rather larger than normal. No stones were in it. Toward the cystic duct there was a projection of liver 8 cm. long, 4 cm. wide and not quite 1 cm. thick folding down around the left side of the gall-bladder nearly to its lower median line. From this projection of liver a firm peritoneal membrane passed to the duodenum which it held very firmly, close up under the liver. This membrane also passed to the cystic duct and caused a sharp kink in it. Pylorus and stomach: normal except for the dilation. Gall-bladder: opened and exposed, dark bile was obtained but there were no stones. Mucous membrane looked perfectly normal. Wound in gall-bladder closed. Common duct and pancreas: showed no evidence of stone or other disturbance. Liver: seemed normal in every way. Cæcum: somewhat dilated. Appendix: free. Right edge of omentum ran downward and outward, its base passing around the hepatic flexure and down the ascending colon. It covered practically the whole ascending colon and was adherent to parietal peritoneum along outer side of colon. Procedure: Mobilization duodenum downward about 5 cm. Omentum was separated from ascending colon and cæcum and from adhesions to external parietal peritoneum with resulting release of ascending colon. Appendectomy. Because of opening and suturing of gall-bladder a small cigarette drain was passed through the outer angle of the wound. This was removed on the second day. Convalescence: Uneventful, but somewhat slow because of the physical prostration preceding operation.

Result: Three years. After the first few weeks he has been perfectly well in every way. Has recovered his old-time vigor and has absolutely no digestive disturbance. Cured, three years.

Case XXIII, E. S., F. Twenty-two years. Typhoid when ten years old. Headaches frequent ever since. Periods began at fourteen; regular, scanty, pain at start. When seventeen years of age she became fatigued very easily, and lost weight and color. When nineteen years old she had to give up college because of

fatigue, constipation, pain and flatulence. Chronic appendicitis was diagnosed and the appendix removed. Recovery was slow and there was no relief whatever but the symptoms were aggravated, and for about a year the attacks of pain, nausea, flatulence and constipation varying in severity and frequency almost completely disabled her. The attacks of pain have lately been associated with diarrhœa. She has become very nervous and "jumpy" and often has vertigo. The pain has gradually become most definite in the right lower quadrant.

P. Ex.: She is a good sized, somewhat fat, pale young woman. Heart, lungs, urine and blood: normal. Abdomen: somewhat prominent, and tympanitic; tender over the cæcum, gall-bladder and just to the right of the mid-epigastrium.

X-ray series: Stomach: fish-hook, dilated markedly; not emptied until four and one-half hours. Peristalsis active; no evidence of ulcer. Duodenum: apex fixed high, cap small and somewhat irregular but not suggestive of ulcer. Stasis: in ileum marked at 8.5 hours; in cæcum and ascending colon at 36 hours and 48 hours, respectively. Cæcum: dilated; often in true pelvis. Transverse colon: ptosed, dips into true pelvis. Hepatic flexure: sinks often to level of iliac crest. Gall-bladder and urinary system: negative. Preoperative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Postoperative adhesions.

Operation: 3-26-18. Incision: T. R. R. Two and five-tenths cm. above navel. Findings: Hepato-duodeno-colic membrane from gall-bladder and cystic duct to pylorus and beginning duodenum, holding them fast beneath liver and to transverse colon. Stomach: deflated; of moderate size; no ulcer. Adhesion: inflammatory; from the under surface of quadrate lobe to peritoneum overlying vena cava. No origin discernible. Omentum: adherent to appendix scar. Pericolic membrane: covered entire ascending colon, the upper end of which made one complete loop behind the membrane at the hepatic flexure. Pelvic organs: infantile. Lymphadenitis: retroperitoneal in ileocæcal angle. Procedure: Mobilization duodenum downward 6 cm. Mobilization ascending colon and freeing of loop. Separation of omental adhesions. Removal of some lymph-glands. Pathological report: Tubercular lymphadenitis with calcified areas. (Healed?) Convalescence: Uneventful.

Result: At nine months tremendously improved; had gained much in weight, color and energy and was back at her studies. At three years, nine months: occasional pain, flatulence and constipation. Appetite very good; no restrictions as to food. As a rule is much better than before operation. Much improved, three years, nine months.

Case XXIV, G. S., F. Forty-four years. Has always had digestive disturbance but paid little attention to it. Periods began at twelve, always irregular, scanty, but without pain. When forty-two had several attacks of persistent metrorrhagia spread over the following year. When these finally stopped she had a marked increase in her digestive disturbances with pain, slight nausea and a sense of dragging down the stomach after eating. When forty-four years old she had a severe attack of pain, nausea, vomiting, diarrhœa, with pain and tenderness in the right lower quadrant which lasted a week. Four days later a more severe attack was associated with great abdominal distention, with chilly sensations. For six weeks had noticed a small tumor in right breast. For nineteen years varicose veins in right leg.

P. Ex.: She is of medium-sized frame, emaciated and pale. Artificial teeth. Throat, heart, lungs, urine and stool: negative. Blood: Hæmoglobin, 80 per cent.; red blood-cells, 4,000,000. Small benign tumor in right breast. Thrombosed varicose veins about inner side right knee. Abdomen: distended with gas, especially on the right side; the walls flabby and thin. Cæcum: is dilated and gurgles on pressure; is tender to its inner side; marked localized tenderness over

the appendix. Tenderness in mid-epigastrium. Stomach: much dilated; tympanitic and prolapsed.

X-ray series: Stomach: marked fish-hook type; lower border in true pelvis; atonic peristalsis; no evidence of ulcer; pyloric end well over in right side. Duodenum: apex fixed high at lumbar ii, and in same position both in erect and prone plates; cap not filled out and irregular, especially in erect posture, but not suggestive of ulcer. Cæcum and ascending colon: dilated. Hepatic flexure: fixed at same level as duodenum apex and obviously constricted, barium not passing it in the first twenty-four hours. Transverse colon: hangs into true pelvis in the forty-eight-hour plate. Appendix: visualized in twenty-four-hour plate. Pre-operative diagnosis: Hepato-duodeno-colic membrane. Pericolic membrane. Chronic appendicitis. Benign breast tumor. Thrombosed varicose veins.

Operation: 4-8-18. Incision: T. R. R. Just above navel. Findings: Stomach: much dilated; well over in right side; bent sharply back, up and inward to pylorus and duodenum. No ulcer. Liver and gall-bladder: normal, except for membrane. Hepato-duodeno-colic membrane: from middle of gall-bladder backward to cystic duct where the apex of duodenum was held up tight and sharply kinked. The membrane extended down first part of duodenum to lower border of pylorus and then over to beginning transverse colon, where it was continuous with: Pericolic membrane: extensive; covered whole ascending *colon* and *cæcum;* it crossed upper colon and hepatic flexure to transverse colon and joined hepato-duodeno-colic membrane causing a U-shaped bend of the transverse colon behind the veil with triple angulation and marked obstruction. Cæcum: dilated; adherent to iliac fossa; covered by pericolic membrane. Appendix: moderate size; adherent. Pelvic organs: negative. Right kidney: rather large. Left kidney: rather small. Procedure: Mobilization of duodenum downward. Mobilization of cæcum and colon. Appendectomy. Removal of breast tumor. Removal of varicose veins. Canvalescence: Uneventful.

Result: No pain; no flatulence; no constipation; good appetite; no restrictions in diet. Has gained weight, color and strength. Cured, fifteen months.

Case XXV, C. W., M. Sixty-five years. For many years indigestion with colicky pains and flatulence, but no constipation. At sixty years strained his back, and always weakened since. At sixty-two years digestive trouble became progressively worse, with increased pain, flatulence and constipation which became obstinate, anorexia, and loss of twenty pounds in two months. There was increasing weakness. Never vomited, never passed blood and has never had any urinary disturbance.

P. Ex.: He is of good-sized frame, muscular, well nourished and of good color. Heart, lungs, urine and blood were negative. Abdomen: distended; tympanitic; muscles strong and firm, tender over the cæcum (which is not distended), over the gall-bladder region, in the mid-epigastrium and in the right costo-vertebral angle. No growth can be made out anywhere.

X-ray series: Stomach: not enlarged; peristalsis vigorous; has passed seventy-five per cent. of meal in two hours, no sign of ulcer or malignancy. Duodenum: apex fixed at upper edge lumbar ii and varies scarcely one cm. between erect and prone position. Cap somewhat distorted as though by periduodenal adhesions. (Series could not be completed because of patient's condition at the time.) White blood-cells, 12,000; S. L., 23 per cent.; polymorphonuclears, 75 per cent. Rectum: negative. Prostate: moderately enlarged, firm, but not tender. Pre-operative diagnosis: Hepato-duodenal membrane. Possible malignant growth.

Operation: 5-4-18. Incision: T. R. R. Just above the navel. Findings: Stomach: not enlarged; walls somewhat thickened. Duodenum: apex was held close up under cystic duct by hepato-duodenal membrane running from proximal

gall-bladder, and causing high fixation and marked angulation. This membrane did not fuse into the gastro-hepatic omentum as usual but was clearly separated. Pancreas: normal. Cæcum: bound by postero-external adhesions. Appendix: 7 cm. long, bulbous; intensely congested. Pericolic membrane: covered ascending colon; with one thickened band compressing the middle of the gut and another fixing the hepatic flexure high and kinking it. Liver, gall-bladder, transverse colon, splenic flexure, descending colon and rectum showed nothing abnormal. Prostate: somewhat enlarged; firm; not nodular. Kidneys and bladder: negative. Lymphatic glands about the internal iliac vessels on both sides were greatly enlarged and somewhat matted together. No cause could be identified. Procedure: Mobilization of duodenum downward 5 cm. Mobilization of colon and hepatic flexure and cæcum. Appendectomy. Convalescence: Uneventful, except for phlebitis in left calf. Returned home in good condition on twenty-fourth day, with very little digestive disturbance.

Result: After a few weeks pain recurred, especially in lower abdomen; eight months later urinary symptoms appeared; the prostate became nodular and he eventually died of carcinoma of the prostate. Failure.

Case XXVII, R. T., F. Eleven years. Always athletic; appetite always large. Always subject to car-sickness. Always marked constipation, coated tongue and bad breath. Not much flatulence; occasional nausea but no vomiting. During her eleventh year she had irregular attacks of pain in right side of abdomen.

P. Ex.: She is large and muscular but pale and pasty. Mouth-breather as result of broken nose. Heart, lungs and urine: normal. Abdomen: normal to inspection; tender over cæcum, and especially under right rectus near navel. Sigmoid: spastic but not tender; no tender areas in upper abdomen. Cæcum: dilated and apparently thickened and tender. Liver: edge 3.5 cm. below free border but not tender.

X-ray series: Omitted because of time and expense. Pre-operative diagnosis: Pericolic membrane. Chronic appendicitis.

Operation: 5-11-18. Incision: Intramuscular at level of navel with Weir's modification. Findings: Cæcum: dilated; walls not thickened; filled with putty-like fæces. Appendix: small; adherent; containing several concretions. Pericolic membrane: with one band constricting colon just above cæcum and another angulating and constricting hepatic flexure. Hepato-duodenal membrane: fixing high and kinking duodenal apex. Liver and gall-bladder: normal, except for membrane. Pelvic organs: normal. Procedure: Mobilization of colon. Mobilization of duodenum. Fortunately the membrane was thin and avascular. It was divided but no suturing could be done. Appendectomy. Convalescence: Uneventful.

Result: Complete relief of symptoms; gain in weight and color; no constipation. Cured, three years, seven months.

Case XXXII, A. L., F. Thirty-four years. Always suffered from great digestive disturbance. No pain but anorexia, nausea, flatulence and obstinate constipation. No headaches. These troubles have increased, especially since the thirty-second year, with frequent attacks of extreme fatigue, and with distinct loss of color and some loss of weight. Since thirty-one had several attacks of influenza. Periods: regular, scanty.

P. Ex.: She is tall, emaciated and pale. Eighty-six pounds weight. Heart, lungs and urine: negative. Blood-pressure, 100/80. Extremely nervous, restless and with muscles twitching. Abdomen: somewhat scaphoid; muscles irritable; tender; over spastic sigmoid; over middle of right rectus three cm. below navel, marked and localized. No tenderness in upper abdomen. No marked flatulence.

X-ray series: Stomach: fish-hook type; down to sacral promontory; 29 cm.

long, 7 cm. wide; shows fair peristalsis. Empty at six hours. Duodenum: apex; erect, lower border lumbar iii; prone, upper border lumbar ii. Cap deformed, small, and apex sharply angulated. Cæcum and ascending colon: dilated. Hepatic flexure: mobile but always angulated. Transverse colon: prolapsed; in true pelvis; and showing stasis. Appendix: visualized throughout and segmented. Gall-bladder: negative. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 6-6-18. Incision: T. R. R. Two and five-tenths cm. above navel. Findings: Stomach: enlarged, pylorus dilated; otherwise negative. Duodenum: apex fixed high and kinked beneath cystic duct by membrane (hepato-duodenal membrane) running out nearly half way to fundus of gall-bladder. Liver: perihepatitis; upper surface and edge of right lobe. Gall-bladder: normal, except for membrane. Duodeno-jejunal angle; negative. Pericolic membrane: covering cæcum and whole ascending colon; quite thick; and with thick bands running across cæcum, the middle of ascending colon, and especially across hepatic flexure, causing obstruction and kinking. Transverse colon: long and prolapsed; free from adhesions. Appendix: atrophic; subperitoneal against cæcum. Pelvic organs and kidneys: normal. Procedure: Mobilization duodenum downward 6 cm. Mobilization cæcum and colon. Appendectomy. Convalescence: Uneventful but slow.

Result: No pain; occasional flatulence. Moderate constipation. Appetite much better; more general diet. Gained ten pounds. Color improved; general strength improved. Much improved, three years, six months.

Case XXX, B. M., F. Twenty-nine years. Perfectly well until eleven years old when periods began; irregular, profuse, five to seven days, with much pain. At fourteen years developed rapid pulse and enlarged thyroid; disappearing under treatment. Tonsils removed at this time. At sixteen years had an attack of "appendicitis" but no operation was done. Ever since that time there have been intermittent disturbances of digestion, gradually becoming more frequent and persistent and severe. From twenty-six to twenty-nine years, in addition to the pains, flatulence, and tenderness over the whole right side, there developed headache, occasional nausea, marked pallor and profound fatiguability. She became almost totally disabled. Appetite is fairly good; bowels move without medicine, but the stools are small, occasionally lumpy and with mucus. There is some urinary frequency with discomfort.

P. Ex.: She is of medium size, fairly nourished, pale and pasty with marked acne. Very nervous. Thyroid appears somewhat large. Pulse 80, good quality. Heart, lungs and urine: negative. Abdomen: normal appearance; tympanitic; not tender anywhere on *left* side; moderately tender in mid-epigastrium and over gall-bladder; marked tenderness over cæcum and ascending colon, which are distended, and marked localized tenderness over the appendix.

X-ray series: Stomach: marked fish-hook type; dilated; atonic; with lower edge below sacral promontory. Retention after 4.5 hours; no evidence of ulcer. Duodenum: apex at lower edge of lumbar ii in both erect and prone pictures; cap small in erect, and filled in prone pictures. No evidence of ulcer. Apex angulated. Second portion narrow. Cæcum and ascending colon: dilated below, constricted above, showing 48-hour stasis. Hepatic flexure: fixed high, level of upper border of lumbar ii, near duodenal apex; sharply angulated and constricted. Transverse colon: markedly prolapsed. Appendix: retains barium throughout the series; segmented. Enema shows incompetent ileocæcal valve. Gall-bladder and urinary apparatus: negative. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 6-11-18. Incision: T. R. R. Two cm. above navel. Findings: Stomach: much enlarged; well over in right flank; bent back, up and in to

duodenum. Negative otherwise. Hepato-duodenal membrane: pylorus and duodenum fixed almost in contact with gall-bladder by short membrane from fundus to cystic duct. Duodenum: apex angulated and compressed. Liver and gall-bladder: normal except for membrane. Pericolic membrane: covered cæcum and colon up to hepatic flexure; two thickened bands, one just above cæcum and one at flexure causing elevation, angulation and compression. Appendix: very long, tortuous, with very short mesentery. Pelvic organs and kidneys: normal. Procedure: Mobilization duodenum, downward 6 cm. Mobilization, cæcum and ascending colon. Appendectomy. Convalescence: Uneventful.

Result: No pain; occasional flatulence; and mild constipation; appetite good; eats everything; gained some weight; much improved in color, and especially in endurance. She says she is "made over." Much improved, three years, six months.

Case XXXIV, R. M. G., M. Sixteen years. He has always been well, except for occasional attacks of indigestion, until fifteen and one-half years old, when he had a sore throat followed by cervical lymphadenitis. Shortly afterward a severe colitis developed and lasted about seven weeks, with the final development of pain in the right lower quadrant, which has persisted ever since. There has been no nausea or vomiting. Some loss of weight, color and stamina.

P. Ex.: He is tall, well developed, slender, and with fair color. Heart, lungs, gastric contents and stool: negative. Urine: 1023, trace albumin, trace acetone, hyaline casts. Abdomen: normal appearance; normal tympany. Tenderness: over sigmoid; marked over appendix; slight in mid-epigastrium.

X-ray series: Stomach: fish-hook type; average size; peristalsis good; almost empty at four hours. No ulcer. Duodenum: apex somewhat fixed; cap normal; no sign of ulcer; some puddling in dependent portion with moderate reverse peristalsis. Slight ileac stasis. Cæcum: moderately dilated. Appendix: visualized throughout examination and tender on pressure. Hepatic flexure: some angulation; fixed high. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis. Possible duodeno-jejunal obstruction.

Operation: 6-17-18. Incision: T. R. R. Two and five-tenths cm. above navel. Findings: Stomach: very much enlarged; pushed over into right side; bent back, in and up to duodenum. Otherwise pylorus and stomach negative. Duodenum: apex fixed high and sharply kinked. No ulcer. Hepato-duodeno-colic membrane: extended to fundus of gall-bladder and ran directly to hepatic flexure, which was held against gall-bladder and sharply kinked. Remainder of membrane ran to duodenum. Liver and gall-bladder: normal except for membrane. Duodeno-jejunal angle: negative. Pericolic membrane: covered cæcum and ascending colon almost to flexure; two thick bands; one just above cæcum, one just below flexure, causing compression. Cæcum: greatly dilated; very thin-walled, especially external pouch. Appendix: long; irregular calibre; adherent at tip. Kidneys normal. Procedure: Mobilization duodenum downward 5 cm. Mobilization cæcum and colon and hepatic flexure. Appendectomy and plication of cæcum. Convalescence: Uneventful except for cystitis on fourteenth day, which lasted four days.

Result: Perfectly well and strong in every way. Cured, three years, seven months.

Case XXXV, C. B., M. Thirty-five years. He was well until about thirty years old, when without known cause he became profoundly neurasthenic with marked fear of going about alone, with tremors, perspiration, pallor, etc. Pulse was usually 72 to 80, blood-pressure 125 to 135 mm. even when he said he was about to faint. Had much vertigo. Careful physical examination could not detect a single physical thing that was wrong. During the next five years medical treatment, psychic treatment, rest cures, farm cures, etc., were tried seriatim

with only temporary and slight improvement. His digestive system seemed to be working normally. At thirty-three years he began to have occasional discomfort in the right iliac fossa, becoming more frequent, then pain on moving right leg and hip. These troubles had become constant and annoying by the end of two years, and were associated with vertigo and much flatulence. Appetite was good and bowels slightly constipated. He had been completely disabled (as to work) for five years.

P. Ex.: He is of medium size, well developed, fat, rather pale, nervous and fearful. Heart, lungs, thyroid, urine: negative. Abdomen: moderately distended; wall quite fat; tympanitic everywhere, especially over stomach, which extended down to navel and over to right mammary line. Splashing was easily elicited. Tenderness: along outer edge of right rectus at and below the level of the navel; over the gall-bladder, causing also sticking pain in left upper abdomen. No distention of the cæcum could be made out.

X-ray series: Stomach: fish-hook type; lower border at lumbar iv; peristalsis active; empty in three hours; no indication of ulcer. Duodenum: apex at upper border lumbar ii prone, and lumbar iii erect. Cap well filled. No evidence of ulcer. Adhesions indicated about beginning transverse colon Cæcum and appendix inverted and beneath liver. Appendix: tender during fluoroscopy. No gall-stones. Pre-operative diagnosis: Hepato-duodenal membrane. Chronic appendicitis. Inverted cæcum.

Operation: 6-19-18. Incision: T. R. R. Findings: Stomach: enlarged, crowding over to right side, then bending back, up and in to. Duodenum: fixed high and sharply kinked, and held firmly against proximal gall-bladder by hepato-duodenal membrane. Cæcum and appendix: inverted beneath liver; they have long mesenteries and are freely movable. Pericolic membrane: involving upper half of ascending colon and crossing to beginning transverse colon, causing kinking and constriction at hepatic flexure. Cæcum and first part of colon bent up around the lower edge of membrane. Procedure: Mobilization of duodenum downward 5 cm. Mobilization of colon and hepatic flexure. Appendectomy. Cæcum tacked in normal position. Convalescence: Uneventful.

Result: With ups and downs he gradually became entirely free from his digestive disturbances and also from his neurasthenic troubles. He returned to business and was doing well. When at his best he contracted encephalitis lethargica. Even so, there has been no digestive disturbance of any kind. Digestive cure, three years, six months.

Case XXXVII, A. J. M., F. Forty-four years. She has always been subject to some indigestion. When twenty-nine her first child was born; she was badly torn; had a marked prolapse. Her general condition ran down seriously and she lost forty pounds weight. When thirty-three years old she had complete perineal repair and laparotomy for ventral suspension. The appendix was removed at that time. Within a week she developed severe pain and distention on the right side of the abdomen and marked constipation. Ever since that time she has had constant pain in the right side of the abdomen and down the right leg, increased by exercise, and by constipation. Always a few hours after meals the cæcal region becomes distended with gas, which gurgles and starts severe pain in the abdomen and leg. Constipation is obstinate. She seldom has any trouble attributable to the stomach proper. She has become very irritable, nervous, her head is not clear, she fatigues easily, and is much disabled. Her periods are regular, scanty and short.

P. Ex.: She is of medium frame; quite overfat; pale; pasty and with flabby tissues. Nervous, erratic. Heart: shows distinct myocarditis but is working reasonably well. Blood-pressure, 110 mm. Lungs, urine, gastric contents and stool: negative. Blood: Hæmoglobin, 65 per cent.; red blood-cells, 4,000,000.

Wassermann: negative. Abdomen: fat, very flabby, distended with gas, especially right side. No rigidity. Median scar above pubes. Tenderness: over middle of ascending colon; none over cæcum, gall-bladder, or mid-epigastrium. Pelvic examination: Stellate tear of cervix; cyst in anterior lip. Uterus: normal size; freely movable; slightly tender over fundus.

X-ray series: Stomach: marked fish-hook type; lowest point lumbar iv; peristalsis active; empty in three hours; no evidence of ulcer. Duodenum: apex at lower edge lumbar ii, standing and prone, *i.e.*, fixed; sharply angulated. Cap: small, irregular, no evidence of ulcer. Cæcum and ascending colon: dilated; marked stasis at seventy-two hours, distortion toward the hepatic flexure, which was fixed high and in contact with duodenal cap, and showed marked angulation and constriction. Transverse colon: in every plate its shadow was fused with that of ascending colon from the flexure half way to cæcum and then turned at right angle to go to splenic flexure. It and descending colon were small (spastic?) throughout. Following the enema the same conditions were present and after evacuation cæcum and colon still retained much barium. Gall-bladder: no sign of stones. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Post-operative adhesions.

Operation: 6-24-18. Incision: T. R. R. Six cm. above navel. Findings: Stomach: somewhat enlarged; crowded over to right; bent back, up and in, to duodenum. Hepato-duodeno-colic membrane: from fundus of gall-bladder directly to hepatic flexure holding the two in contact and angulating flexure; membrane then ran to duodenum, holding its apex high and sharply angulated beneath cystic duct; one thick band ran down across duodenum to near pylorus. Pericolic membrane: across ascending colon from just above cæcum nearly to flexure, causing compression and distortion. Omentum crossed ascending colon and fused with pericolic membrane. Adhesions: Cæcum to iliac fossa where appendix had been removed. Omentum to old median incision, in which adhesions some loops of small gut were caught. Pelvic organs: normal except for suspension of uterus. Kidneys: normal. Pancreas and duodeno-jejunal angle: negative. Procedure: Mobilization duodenum downward 7 cm. Mobilization cæcum, colon and hepatic flexure. Separation omental adhesions and freeing of coils of small gut. (Tissues all very friable.) Convalescence: Uncomfortable but uneventful. The twelfth day the pain in right leg began to disappear and on the sixteenth day ceased. On the twenty-first day had a normal spontaneous stool for the first time in several years. Two months after operation: no pain in abdomen; only occasional flatulence; had gained ten pounds.

Result: No pain; occasional flatulence and constipation. Color, appetite and general strength greatly increased. Much improved, three years.

Case XXXIX, A. B., F. Twenty-eight years. For several years subject to bilious attacks, and to pain, distention and belching after meals. Often had severe cramping in lower abdomen, but none since twenty-six years old. Appetite always good. Constipation always. Periods began at thirteen, regular, three and one-half days, moderate, no pain. Always easily fatigued.

P. Ex.: She is large, fat, pale. Heart, lungs, urine: negative. Abdomen: is prominent; very tympanitic, especially over colon, and stomach which seems to reach level of navel. Tenderness: over appendix; over gall-bladder region; and in mid-epigastrium. Pelvic examination: negative.

X-ray series: Omitted for reasons. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appenditicis. Gall-stones(?).

Operation: 11-14-18. Incision: T. R. R. Three cm. above navel. Findings: Stomach: somewhat enlarged, otherwise normal. Hepato-duodenal membrane from fundus and whole of gall-bladder to pylorus and up duodenum to its apex which was held fast and angulated just beneath the cystic duct. Pericolic mem-

brane: running upward and inward across colon just above cæcum. Appendix: very long, angulated; irregular in calibre. Liver and gall-bladder: normal, except for membrane; no gall-stones. Hepatic flexure: normal. Kidneys and pelvic organs: normal. Procedure: Mobilization duodenum downward 5 cm. Mobilization colon. Appendectomy. Pathological report:. Chronic appendicitis. Convalescence: Uneventful.

Result: Occasional pain; considerable flatulence; some constipation. Appetite good; no restrictions in diet. Much improved in color and in general strength. Much improved, three years, six months.

Case XL, E. S., F. Forty-six years. Perfectly well and strong until eighteen years old, when she had typhoid. When twenty-one years old she had severe abdominal pain, sharp, radiating to left shoulder and lasting half an hour. Similar attacks came twice a day for a week. Following the pain came nausea. The next bad attack came ten years later when she was thirty-one, and thereafter attacks recurred at irregular intervals, becoming constantly more frequent and more severe. By the time she was forty-one the pain was so aggravated by walking, or other exercise, that she became sedentary. Of late the attacks are associated with marked flatulence, nausea, and diarrhœal tendencey. Also temperature frequently accompanies them, varying from 101 to 105 F. Appetite has been good until lately. Marked loss of strength has occurred in last few months. Subject to occipital headache. Finger joints have enlarged and are painful, Lately the pain has focussed more in the right hypochondrium. There never has been any jaundice, urinary or menstrual disturbance. She is seriously disabled.

P. Ex.: She is of large frame, well developed, well nourished, somewhat pale. Heart, lungs, urine and stools: normal. Abdomen: normal in appearance; respiration is thoracic and abdominal breathing obviously painful. Pressure anywhere over abdomen causes gurgling of gas. Stomach tympany goes to 5 cm. above navel. Tenderness: marked at edge of right rectus on level A. S. S.; over cæcum and ascending colon; especially over gall-bladder, and along transverse and descending colon. Tympany: exaggerated everywhere except just below eighth and ninth right cartilages where there is dulness.

X-ray series: Stomach: fish-hook type, lower edge at lumbar v; peristalsis good; no sign of ulcer; empties in normal time. Duodenum: apex; lower border lumbar i prone, lumbar ii erect; angulated; no sign of ulcer. Descending limb appears to be held to liver by adhesions. Cæcum and beginning ascending colon: dilated; show stasis 48 hours. Appendix: not visualized. Hepatic flexure: narrowed; angulated. Diverticulitis: transverse and descending colon. Incompetency of ileocæcal valve. Gall-bladder: enlarged. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis. Cholecystitis—calculi. Diverticulitis coli.

Operation: 12-20-18. Incision: T. R. R. Four cm. above navel. Findings: Stomach: slightly enlarged; otherwise normal. Duodenum: apex fixed high and angulated. Gall-bladder: dilated; 4 cm. beyond edge of liver; very tense; containing large calculus at outlet. Cystic duct very small; common duct dilated. Liver: normal. Hepato-duodenal membrane: much thickened and running from proximal half of gall-bladder to duodenum. Pancreas: normal. Cæcum: dilated and thinned. Pericolic membrane: crossing just above cæcum and extending nearly to flexure and compressing ascending colon. Hepatic flexure: free. Appendix: small, atrophic. Diverticulitis: transverse and descending colon and sigmoid. Multiple small fibroids. Procedure: Cholecystectomy: liver bed covered peritoneum, stump of cystic duct buried beneath peritoneum. Mobilization duodenum 6 cm. Mobilization colon. Appendectomy. Closed without drainage. Convalescence: Uneventful except for vomiting the first forty-eight hours.

Result: Some pain, but never severe. Flatulence frequently. Tendency

to constipation; laxative every third night. Appetite very good. Some restrictions of diet. Gained ten pounds and much in strength and endurance. Much improved, three years.

Case XLI, G. F., F. Thirty-two years. Always had trouble with flatulence and belching of gas, and constipation, but usually no pain. Once a month, usually with her periods, she has a bilious attack, headache, vomiting, etc., lasting one day. Periods regular, three days, profuse, with much pain. Appetite is good. She has always been pale, but more so lately. Always markedly constipated. Dyspnœa on exertion; fatigues easily. In October, 1918 (thirty-two years old), with her bilious attack, she developed sharp pain and tenderness in right iliac fossa. Pain lasted one day, tenderness five days, since when it has diminished but never disappeared.

P. Ex.: She is tall, of large frame, fairly nourished, but quite pale and pasty. Weighs 118 pounds. Heart: normal, except for blowing murmur over left second space. Pulse: 96 (nervous), regular, and of fair quality. Lungs and urine: negative. Abdomen: distended; markedly tympanitic. Stomach: tympany and splashing down to navel and well over to the right side. Marked tenderness at outer border of rectus on line from R. A. S. S. to navel.

X-ray series: Stomach: fish-hook type; lower edge below sacral promontory; peristalsis active; considerable six-hour retention; no sign of ulcer. Duodenum: apex fixed at upper level of lumbar iii in both prone and erect postures. Cap shows no deformity but is small; slight puddling and reverse peristalsis in dependent duodenum. Cæcum and ascending colon: dilated; marked stasis. Hepatic flexure: at iliac crest; shows some narrowing and angulation. Appendix: visualized throughout examination. Ileocæcal valve: incompetent. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 1-15-19. Incision: T. R. R. Two cm. above navel. Findings: Stomach: much enlarged; over in right side, bent back, up and in to duodenum; no ulcer. Duodenum: apex fixed high and kinked sharply. Hepato-duodenal membrane: from cystic duct and proximal gall-bladder (narrow and 3 cm. long) to apex of duodenum. Duodeno-jejunal angle: normal. Pancreas: normal. Gall-bladder: long but normal, except for membrane. Liver: normal. Cæcum: much dilated; thin; pale; adherent to iliac fossa. Appendix: long segmented; irregular; adherent. Pericolic membrane: thick, firm; compressing colon from cæcum about two-thirds of distance to hepatic flexure. Right edge of omentum crossed colon obliquely above cæcum to membrane, and caused deep oblique compression of ascending colon. Hepatic flexure: adhesions between the two limbs, causing sharp angulation. Multiple small fibroids. Ovaries small and cystic. Procedure: Mobilization duodenum; cæcum; colon and hepatic flexure. Appendectomy. Cæcum plicated. Convalescence: Uneventful. On the twenty-first day could eat more food with less discomfort than for years.

Result: Occasional slight pain but in lower abdomen and different from old pain; slight flatulence; slight constipation; laxative twice a week. Appetite very good; can eat everything. Color improved; has great improvement in strength but is not entirely well. Much improved, two years.

Case XLIII, L. W., F. Thirty-three years. Perfectly well until twenty-two years old, when she began to have attacks of abdominal pain about twice a year, lasting a few days. When twenty-five years old she had a severe attack with nausea and vomiting. Shortly afterward her appendix was removed. Until twenty-eight years old she was free from pain and indigestion, but then began to have attacks of sharp epigastric pain several hours after meals, coming at irregular intervals. Abstention from food caused no change in the pain. It was very likely to follow periods of nervous tension. These pains ceased at thirty years, but were followed by dull aching pain, with much gas distention and tenderness,

especially on the right side. Enemata caused temporary relief. These attacks are associated with no temperature, and rarely with nausea. There is a dragging sensation in epigastrium, relieved by bending forward. Constipation persistent. There is lassitude, memory defect, mental inertia; sleep disturbed by dreams, and unrefreshing. Used to have tonsillitis, but not for several years now. Periods used to be irregular and painful but not since thirty-one years of age. Her weight has not varied. Disability is marked; 60 to 75 per cent.

P. Ex.: She is of medium size, well nourished, of good color. Heart, lungs, urine: negative. Tonsils: small, negative. Abdomen: normal appearance; oblique appendix scar on right side, not very sensitive; very tympanitic all over, but especially over cæcum and up to the level of iliac crest. Pressure over cæcum elicits tenderness, gurgling, fulness, extending up to iliac crest. It also causes shooting pains all over the abdomen. No tenderness above level of iliac crest on right side, nor over gall-bladder. Moderate tenderness in mid-epigastrium and over sigmoid, which was spastic. Kidneys: negative.

X-ray series: Stomach: fish-hook type; lower border at sacral promontory in erect posture; peristalsis hypertonic; empty at three hours. Spot on middle of lesser curvature suspicious of penetrating ulcer, but it caused no defect in peristalsis. Duodenum: apex; prone at level lumbar i; not angulated; cap, normal. Erect at level lower edge lumbar ii, but angulated; cap smaller and elongated. Dependent duodenum shows slight puddling. Ileac stasis: moderate. Cæcum: much dilated; somewhat prolapsed. Ascending colon: dilated below; somewhat narrowed near flexure. Hepatic flexure: close up to duodenum cap; some angulation. Marked retention in cæcum and ascending colon. Ileocæcal valve: incompetent. Gall-bladder: shadow enlarged; no calculi. Pre-operative diagnosis: Hepato-duodeno-colic membrane. Pericolic membrane. Cholecystitis(?). Duodeno-jejunal obstruction(?).

Operation: 1-31-19. Incision: T. R. R. Just above navel. Findings: Stomach: slightly if at all enlarged; no evidence of ulcer on lesser curvature. Duodenum: fixed high, angulated and compressed. No ulcer. Hepato-duodeno-colic membrane: much thickened, starting three cm. back of fundus, running from gall-bladder and cystic duct down to duodenum, across its first portion and on to hepatic flexure. The anterior edge was very thick and rigid and about 0.5 cm. in diameter. It caused marked kinking and compression of duodenum and high fixation and kinking of the flexure. Liver and gall-bladder: normal, except for membrane. Duodeno-jejunal angle and pancreas: normal. Cæcum: much dilated; thin, pale, adherent posteriorly. Pericolic membrane: dense; crossing colon just above cæcum and extending almost to flexure, and causing visible compression. Terminal ileum: normal. Pelvic organs: normal, except that right ovary was fibrotic. Kidneys: normal. Procedure: Mobilization duodenum downward 4 cm. Mobilization colon, cæcum and hepatic flexure. Plication of cæcum. Convalescence: Uneventful.

Result: No pain; slight flatulence; slight constipation; appetite good; eats wide variety. Gained weight; gained enormously in strength and capacity to work both mentally and physically. Much improved, three years. Practically cured.

Case XLV, H. L. B., M. Forty-eight years. Perfectly well until sixteen years old, when he had sudden pain in left upper abdomen, vomiting and marked constipation. After three days in bed he recovered but has never since felt really well, because of frequent attacks of sour stomach, flatulence, constipation with constant sense of fatigue and lack of rest from sleep. Dieting has prevented the sharp attacks of pain, but he feels wrong in the abdomen all the time. Feels as if an obstruction were in the left upper abdomen. When forty-six he had high blood-uric-acid and high pressure. Under good medical supervision they decreased

to about normal. His constant disturbance disables him considerably. He leads an out-door life.

P. Ex.: He was a large, well-nourished, florid man. Heart, lungs, and urine: normal. Gastric contents: hyperacid. Stools: negative. Abdomen: distended; tympanitic, especially over ascending, transverse colon and stomach. Tenderness is entirely absent. Small umbilical hernia. He points to just beneath tenth left costal cartilage as the area of subjective discomfort, but no objective findings are there.

X-ray series: Stomach: fish-hook type; swings well over to right; lowest part at lumbar v; peristalsis active; empty in four hours. No evidence of ulcer. Duodenum: apex at level upper part lumbar ii, erect, and lower part lumbar i, prone, *i.e.*, marked fixation. Cap is well filled. No ulcer. No puddling in dependent part. Hepatic flexure: fixed and angulated close to duodenal cap. Cæcum and ascending colon: dilated; show stasis after forty-eight hours. Appendix: large, visualized throughout; not tender. Transverse colon: left half showed a marked constriction, spasmodic because of filling later with enema. Ileocæcal valve: incompetent. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 2-20-19. Incision: T. R. R. Two cm. above navel. Findings: Stomach: quite large; pushing well into right flank; otherwise negative. Duodenum: apex fixed high and sharply compressed and kinked; no ulcer. Duodeno-jejunal angle: negative. Appendix: 12 cm. long; dilated; with fibrous cord for tip. Adherent near base. Cæcum: much dilated; filled with semisolid fæces. Pericolic membrane: crossing colon from just above cæcum to about half way to flexure; contained several thickened bands. Hepatic flexure: directly adherent to fundus of gall-bladder by membrane; and to under surface of liver by connective-tissue cord; markedly angulated and constricted. Flexure and ascending colon filled with semisolid fæces. Transverse colon: negative. Splenic flexure unusually high. Hepato-duodeno-colic membrane: holding hepatic flexure to fundus of gall-bladder; passing to lower anterior surface of duodenum; up across its front to the apex which was fixed high and back, and was compressed and angulated. Liver and gall-bladder: negative except for membrane. Procedure: Mobilization duodenum downward 8 cm. Mobilization colon. Appendectomy. Repair umbilical hernia.

Result: Fifth day; died of pneumonia.

Case XLVI, A. G., F. Thirty-one years. Very well until twenty-two years, when she had keratitis and glaucoma (probably specific). When twenty-seven years, after hard climbing, had severe pain in right upper abdomen; then perfectly well until thirty-one years old, when she had sudden pain in the same place, with much flatulence and constipation. Since then there has always been indigestion, with frequent attacks of distention and constipation. Occasionally vomits very sour stuff half an hour after eating. Constipation very marked. Her periods cause aggravation of digestive troubles. She is very nervous and fatigued. Has lost ten pounds in last four months, and is almost completely disabled.

P. Ex.: She is large, very fat, and ruddy. Mouth, throat, lungs, heart, urine: normal. Pulse 80. Abdomen: wall is fat; tympanitic all over, but most in right upper quadrant; tender all along large gut, but more over cæcum and ascending colon, and most over the flexure and gall-bladder.

X-ray series: Stomach: fish-hook type; dilated; well over in right side. No sign of ulcer. Duodenum: apex at level lower lumbar i, prone, and middle of lumbar ii, erect (marked fixation). Angulated; no sign of ulcer. Hepatic flexure: close up to duodenal cap; angulated; the two limbs in contact for some distance. Cæcum: dilated; diameter fifty per cent. greater than upper ascending

colon, which is somewhat constricted. Pre-operative diagnosis: Hepato-duodeno-colic membrane. Pericolic membrane. Chronic appendicitis.

Operation: 2-22-19. Incision: T. R. R. Three cm. above navel. Findings: Stomach: dilated; well over in right side, otherwise negative. Duodenum: apex held high and kinked by an unusually short and rigid gastro-hepatic omentum. Otherwise negative. Liver and gall-bladder: normal; no adhesions and no membrane. Duodeno-jejunal angle: normal. Cæcum: dilated; thin walled. Appendix: much congested; contained concretions. Pericolic membrane: crossing just above cæcum and extending up to hepatic flexure, having thickened bands, above causing kinking and constriction of flexure, and in middle and lower edge causing constriction of ascending colon. Omentum: also attached to upper ascending colon, causing condition seen in picture. Kidneys: normal. Pelvic organs: infantile; left ovary was a cyst 5 to 7 cm. in diameter, freely movable. Procedure: Mobilization duodenum 3 cm. Mobilization cæcum, colon and flexure. Appendectomy. Convalescence: Uneventful.

Result: No pain; occasional flatulence and constipation. Appetite very good; can eat everything. Gained weight and very much in strength. Much improved, two years, ten months. (Almost cured.)

Case XLVIII, M. V., F. Twenty-five years. Always subject to violent headaches, sometimes associated with bilious attacks, more often not. Always some digestive disturbance, but since twenty-one years old has been definitely distressed in upper abdomen with no definite relation to food. It could frequently be started by playing tennis or any other violent arm exercise. When twenty-four had influenza. Since then extremely tired; has lost weight, but there has been no increased digestive disturbance. Always badly constipated. Has constant sense of discomfort in upper abdomen. Periods irregular, prolonged, profuse, with great pain. Tonsils removed when twenty-three because of frequent sore throat.

P. Ex.: She is tall, thin, pale, pasty and with acne. Mucous membranes are very pale. Teeth: irregular, but healthy. Some remnants of tonsil remaining. Heart, lungs, urine: normal. Pulse 72, fair quality. Abdomen: normal to inspection, markedly tympanitic all over. Tenderness: marked over appendix, over gall-bladder and especially just to the right of mid-epigastrium. This last spot has always been tender and there is present some muscle resistance. Elsewhere no tenderness. Pelvic examination shows cervix eroded from discharge. Uterus: retroflexed, retroverted, not tender, freely movable. No tenderness in either fornix. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis. Displaced uterus.

X-ray series: Stomach: fish-hook type; lower border of greater curvature, prone, at lower lumbar iii; erect, at lower lumbar iv. Duodenum: apex, at level of lower border lumbar i, erect position. At upper border lumbar i, prone. Cap deformed in both positions. No sign of ulcer. Second portion narrowed and flattened. Marked six-hour retention. Cæcum: dilated; shows retention beyond ninety-six hours. Appendix: visualized throughout examination. Ascending colon: constricted near upper end. Hepatic flexure: fixed at level of upper border lumbar iii. Angulated. Transverse colon: prolapsed; runs in contact with ascending colon half way to cæcum. Kidneys and gall-bladder region: negative.

Operation: 4-22-18. Incision: T. R. R. Two cm. above navel. Findings: Stomach: somewhat enlarged, pushed over to right of median line. Duodenum: apex, fixed high, definitely angulated. Pylorus, stomach, duodenum: show no intrinsic disease. Duodeno-jejunal angle: normal. Pancreas: normal. Terminal ileum: normal. Cæcum: dilated. Appendix: adherent; 8 cm. long; angulated; distended. Pericolic membrane: crossed middle of ascending colon from above downward, causing slight constriction but allowing hepatic flexure to fall over

it and cause pressure volvulus. Hepato-duodenal membrane: not present, but gastro-hepatic omentum at right edge quite short and thickened, causing high fixation and distinct angulation of duodenum. Gall-bladder: somewhat large and distended; otherwise normal. Liver: normal. Kidneys: normal. Pelvic organs: Uterus, small, retroverted, retroflexed, freely movable, easily placed in normal position. Procedure: Mobilization duodenum. Mobilization colon. Appendectomy. Convalescence: Uneventful. Made rapid progress; great improvement in color and in strength during hospital stay. Pathological report: Chronic atrophic appendicitis.

Result: No pain; no flatulence; slight constipation; excellent appetite, eats everything; has gained much weight and color and is perfectly well as to general health and capacity for work. Cured, two years, eight months.

Case L, C. O., F. Twenty-eight years. Perfectly well until twenty-one years of age, at which time, after losing weight and strength without any definite reason, she had a sense of fulness and weight in the epigastrium after eating, also anorexia. She has never been constipated but has a tendency the other way. Similar disturbance came at irregular intervals, and lasted for varying periods. When twenty-eight years old she had an attack in which pain and diarrhœa were added. These attacks became more frequent and persistent and she never felt well any of the time for the last seven months before operation. She lost ten pounds and afternoon temperature frequently reached 100° F. A morning cough now and then has been associated with a little bloody sputum. She is almost completely disabled.

P. Ex.: She is small, thin and pale. Mouth and throat: negative. Sputum: negative. Chest has been repeatedly negative. Pulse: 110, regular, fair quality. Heart: negative. Urine: normal. Abdomen: normal on inspection and percussion. Tenderness: marked over appendix, hepatic flexure and in median line 5 cm. above navel.

X-ray series: Chest shows evidence of tubercular involvement but not extensive. Stomach: marked fish-hook type, much enlarged. Duodenum: Apex at level lumbar i; angulated; cap deformed but not suggestive of ulcer; dependent duodenum slightly distended. Cæcum: dilated; shows marked stasis. Appendix: large, irregular; retains barium forty-eight hours. Ascending colon: much narrowed near hepatic flexure. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 10-25-19. Incision: T. R. R. Just above navel. Findings: Stomach: somewhat enlarged but otherwise normal. Liver and gall-bladder: normal. Duodenum: first portion normal; no membrane to gall-bladder, but a peritoneal fold ran upward from descending duodenum to the under surface of liver well to the right of gall-bladder. Pulling stomach down would develop a kink in duodenum where the fold was attached. Duodeno-jejunal angle: normal. Pericolic membrane: covered upper cæcum and ascending colon to the flexure, causing marked constriction at upper end. Appendix: adherent; angulated; greatly distended. Kidneys: normal. Pelvic organs: normal, except for cyst of left ovary 6 x 4 cm. Procedure: Mobilization duodenum. Mobilization cæcum and colon. Appendectomy. Convalescence: Normal, except for temperature from 100.6 to 101° F., from fifteenth to twenty-third days, for which no reason could be found in urine, chest or wound. Appetite improved; digestion was comfortable and she was feeling well in spite of temperature.

Result: Occasional pain and flatulence; bowels regular; appetite good; eats everything; gained eighteen pounds. General health and endurance greatly increased. Cured, two years, two months.

Case XXI, C. L. G., F. Twenty-six years. Has always been constipated; no associated headaches, bilious attacks or sour stomach until present illness.

Periods started at fourteen years, always regular without pain. When twenty-two years old had a cold in head with fever and nausea, no pain. On getting up felt extreme fatigue, vertigo and pulse was only sixty. Felt sudden griping sensations just above and to the left of navel. During the following year sour stomach, sour eructations have been frequent and getting steadily worse. Constipation has been much aggravated. She has occasional headache, is very irritable. Has cold hands and feet. Pulse even as low as fifty-one. Gets easily exhausted, either by exercise or any excitement. Has only moderate pain and slight flatulence. She is completely disabled.

P. Ex.: She is a woman of medium size, well nourished with high color (excited). Heart, lungs, urine, etc., negative. Abdomen: normal in appearance, tympanitic throughout. Marked tenderness 5 cm. above navel to left of median line. Very slight tenderness in the appendix region. No tenderness over gall-bladder or in mid-epigastrium.

X-ray series: Stomach: fish-hook type; lower border at level of lumbar iv, peristalsis active. No deformity. No sign of ulcer. Large six-hour retention. Duodenum: cap moderately fixed beneath liver, not tender, average size. No sign of ulcer. Duodeno-jejunal angle: fixed at level of lumbar ii with reduction in diameter of terminal duodenum, marked dilation of dependent duodenum. Appendix: not visualized. No evidence of disturbance of cæcum or ascending colon, which were somewhat prolapsed. There was some regurgitation through the ileo-colic valve from the enema. Pre-operative diagnosis: Duodeno-jejunal angle obstruction. Hepato-duodenal membrane(?).

Operation: 2-26-18. Incision: T. R. R. Three cm. above navel. Findings: Stomach and pylorus: normal. Duodenum: apex, high and kinked. Gall-bladder: somewhat enlarged, otherwise normal. Hepato-duodenal membrane: running from proximal end of gall-bladder and cystic duct to apex of duodenum. Liver: normal. Duodeno-jejunal angle: pulled upward and to the left by a fold of peritoneum, angulated and turned forward and to right in front of superior mesenteric vessels 2 cm. and there caught by a fold of peritoneum which pulled it strongly upward and to the right. The jejunum then turned sharply downward to the left. There was thus formed a Z-shaped distortion with very marked double angulation, causing very obvious obstruction. Cæcum and ascending colon: appeared normal. No sign of pericolic membrane or of obstruction of the colon. Appendix: very long and narrow, showing no signs of inflammation. Pelvic examination: showed uterus normal, except for one small fibroid in the lower posterior segment. Left tube was hydrosalpinx about 2 cm. in diameter. It was freely movable. Both ovaries: normal. Kidneys: normal. Procedure: Mobilization of duodenum. Mobilization of duodeno-jejunal angle (plastic). Appendectomy. Convalescence: Uneventful.

Result: Three years, ten months. No pain; slight flatulence. Appetite good, eats everything. Has gained only three pounds in weight, but has entirely regained vigor and endurance. Much improved, three years, ten months. (Practically cured.)

Case XXXI, J. W., F. Seventeen years. Perfectly well until three years old, when typhoid fever developed. After that had bronchitis, la grippe, chicken-pox. Ever since that time she has had much digestive disturbance, anorexia, constipation, loss of weight, flatulence, discomfort after small amounts of food, severe headaches and great nervous depression with loss of stamina. When sixteen and one-half years old she had bad bronchitis, followed by mumps; later had measles and many attacks of epistaxis. After meals she has frequency of micturition with some burning, almost no endurance; pain usually comes definitely two hours after eating, is eased by lying down. Hands and feet are always

clammy, and she is almost completely disabled. Her periods are regular at five weeks, profuse and with much pain. Bed-ridden at this time.

P. Ex.: Tall, thin, fairly nourished, but has fair color. Pulse 72, good quality. Heart, lungs, urine, stool: negative. Hæmoglobin, 81 per cent.; red blood-cells, 4,740,000. Abdomen: retracted, showing but little flatulence. Stomach: percusses to median line and down to navel. Sigmoid: spastic and tender. Marked tenderness and resistance 3 cm. above navel, just to the left of mid-line. Marked tenderness below right rectus just above level of R. A. S. S. No tenderness over gall-bladder, nor in mid-epigastrium.

X-ray series: Stomach: marked fish-hook type. Greater curvature in true pelvis. Peristalsis: active. No indication of ulcer. Six-hour retention. Duodenum: apex, level of lumbar iv. Cap normal; no sign of ulcer. Descending limb and dependent duodenum filled easily; dilated markedly, showing reversed peristalsis and writhing, and tenderness over the angle. Some stasis in cæcum and ascending colon. At forty-eight hours entire colon was still visualized. Appendix was visualized throughout examination. Hepatic flexure: quite movable; sometimes below, sometimes above iliac crest. Ileocæcal regurgitation. Preoperative diagnosis: Duodeno-jejunal angle obstruction. Chronic appendicitis.

Operation: 5-30-18. Incision: T. R. R. Just above navel. Findings: Stomach and duodenum: normal. Gall-bladder: normal. Duodeno-jejunal angle: showed firm, strong band running upward and to the left, pulling the angle well out and up, causing sharp angulation and constriction by membrane pressing in front of angle. When this band was divided the angle came downward and the duodenal contents very promptly passed the obstruction. There was no evidence of obstruction by mesenteric vessels. Beneath the peritoneum about the mesenteric vessels were several enlarged lymph-glands of which one was removed for examination. The overlying peritoneum was also somewhat thickened. Terminal ileum: negative. Cæcum: was located on a level with the crest of the ilium. It was somewhat dilated. Pericolic membrane: Broad and thick, covered the entire cæcum, ascending colon, hepatic flexure and beginning transverse colon. It caused general compression and some angulation. It showed two thickened bands passing across the mid-portion of ascending colon. There was also a band running from beginning transverse colon up to pyloric antrum of stomach, holding the two firmly in close contact. Appendix: 10 cm. long, rather small calibre, irregular with fairly long mesentery. Beneath the peritoneum in the ileocæcal angle were many lymphatic glands, of which one was removed for examination. Pelvic organs: normal, except for ovoid cyst at fimbriated end of right tube. Kidneys: normal. Spinal column came unusually far forward. Procedure: Mobilization duodeno-jejunal angle. Mobilization cæcum, ascending and transverse colons. Appendectomy. Lymphadenectomy. Removal fimbriated cyst. Pathological report: Calcified lymph-node. Chronic appendicitis. Convalescence: Uneventful.

Result: Three years, seven months. Improved. No pain; some flatulence; some constipation; fair appetite, eats everything. No gain in weight. Improvement in general health and strength. Still troubled with lassitude. Improved, three years, seven months.

Case XXXVI, C. H., F. Forty-five years. As a child had "inflammation of the bowels" for a few weeks. Ever after there was such digestive disturbance that she was not expected to live. She has always had considerable digestive disturbance. When forty-one digestion became very much worse and ever since has given increasing trouble. Attacks are characterized by sudden excess of flatulence, distention and severe pain, often with nausea and vomiting, and great loss of strength; marked constipation, but as far as she knows there has been no fever. About four months before operation, during an attack, the appendix

region was extremely tender to pressure. Since forty-two years of age there have never been any normal movements and the taking of medicine has caused temporary diarrhœa, so there has been serious trouble in the regulation of the bowels.

P. Ex.: She is tall, fairly well nourished, but dragged out, pasty and pale in appearance. She is extremely nervous. Teeth: in bad condition; much pyorrhœa. Tonsils: show infection. Heart, lungs, urine: negative. Abdomen: normal to inspection. Markedly tympanitic everywhere. Moderate tenderness over the appendix region, to less extent over the cæcum. No tenderness over hepatic flexure, gall-bladder, or in the epigastrium.

X-ray series: Not taken for reasons. Pre-operative diagnosis: Pericolic membrane. Chronic appendicitis.

Operation: 6-19-18. Incision: T. R. R. Two and five-tenths cm. above navel. Findings: Stomach: considerably enlarged and pushed over to right side, otherwise normal. Duodenum: normal; no fixation. Gall-bladder and liver: normal. Duodeno-jejunal angle: normal. Cæcum: very greatly distended, thin and pale. Appendix: 12 cm. long, 1 cm. in diameter. Kidneys: normal. Pericolic membrane: dense, thick, upper edge being much thickened, holding hepatic flexure high, causing angulation and very marked constriction. The lower edge was also thickened and crossed ascending colon slightly below its middle. Pelvic organs: normal. Procedure: Mobilization colon. Appendectomy. Plication of cæcum. Convalescence: Uneventful.

Result: Two years, four months. Improved. Some pain and flatulence. Occasional constipation. Appetite good, eats everything. Color and general endurance greatly improved. (Still has infected teeth and tonsils.) Improved, two years, four months.

Case XXVI, D. C., F. Twenty-six years. Usually pretty well, always marked constipation since childhood. Periods began at fourteen, always perfectly regular, painless. Always extremely nervous. When twenty-two years old had an attack of "appendicitis," also two when twenty-three years old and one when twenty-four. During the time between twenty-three years and twenty-four years old there were a number of attacks of abdominal pain associated with inability to flex the right hip. When twenty-four constipation became worse than ever and there was much pain, flatulence, marked lassitude, headache and general discomfort. Restrictions in diet caused marked improvement. In November, 1916, twenty-four years old, there was an attack of pain and tenderness over the appendix, but without vomiting or fever. Every few months since there have been similar attacks. They are becoming more frequent until now the interval is only ten to fourteen days. With the final attack at twenty-six years of age, for the first time there was vomiting and definite localized tenderness. There was no fever and no increased leucocytosis. Her general health and endurance have depreciated so that she is practically completely disabled.

P. Ex.: She is tall, well formed, fairly nourished, pale, extremely nervous. Heart, lungs, urine, gastric contents: negative. Pulse 80, of fair quality. Abdomen: anterior wall slightly retracted; moderately tympanitic everywhere. Tenderness over sigmoid, which was slightly spastic. No tenderness in epigastrium, over gall-bladder or over ascending colon. Cæcum: felt to be somewhat thickened and distended and tender. Sharply circumscribed tenderness over appendix region.

X-ray series: Omitted. Pre-operative diagnosis: Chronic appendicitis. Pericolic membrane(?).

Operation: 5-11-18. Incision: Intermuscular; right side, Weir modification. Findings: Transverse colon: markedly prolapsed. Cæcum: adherent to iliac fossa, fixed by definite pericolic membrane. Appendix: small, fibrous, distended

near tip. Covered also by extension of pericolic membrane. Pericolic membrane: covering appendix, cæcum and ascending colon where there was a firm, thick fold which caused definite compression and distortion. Another band ran obliquely downward across the hepatic flexure, causing angulation. Gall-bladder: normal in appearance and feeling. No hepato-duodenal membrane could be made out. Pylorus and duodenum passed under fundus of gall-bladder. Pelvic organs: normal. Procedure: Mobilization of cæcum and colon. Appendectomy. Convalescence: Uneventful.

Result: One year, eight months, much improved. Some pain and flatulence. No constipation. Appetite good. Gained thirty pounds in weight and improved much in general strength. Much improved, one year, eight months.

Case XXXVIII, J. T. S., M. Forty-six years. For fifteen years has had marked digestive disturbances. Was treated at various times for hyperacidity, ulcer, etc. Troubles are getting worse with occasional improvement. Chief difficulty is pain and distress after food; heart-burn, sense of heaviness and discomfort, profound fatigue and headaches. There has been some loss of weight. Very marked disability. There is always mental inertia, some confusion and little capacity for brain work. Constipation is usually present. Marked flatulence. There is dull pain at level of navel which is not influenced by food. On the whole, his troubles are becoming worse rather than better.

P. Ex.: He is a tall, well-developed man; thin, sallow looking and with the appearance of constant suffering. Pyorrhœa and foul breath are obvious. Heart, lungs, urine, stool: negative. Abdomen: somewhat prominent, although there is no fat. It is markedly tympanitic everywhere. Stomach: enlarged down to umbilicus and over into the right side. Splashing is readily obtained at any time. Sigmoid: spastic and moderately tender. Moderate tenderness over appendix region. Otherwise examination was negative. Gastric analysis shows nothing of interest except hypersecretion and hypermotility.

X-ray series: Stomach: fish-hook type; within average size. peristaltic waves quite active; occasional pylorospasm, no sign of ulcer. Duodenum: Cap filled promptly; normal in size and appearance. No indication of ulcer. It is fixed and somewhat angulated. Dependent duodenum: Showed some dilation, marked reverse peristalsis with writhing, twisting, very suggestive of obstruction at the duodeno-jejunal angle. Remainder of series not permitted. Pre-operative diagnosis: Obstruction at duodeno-jejunal angle. Chronic appendicitis(?).

Operation: 6-16-18. Incision: T. R. R. Just above navel. Findings: Stomach: enlarged; pushed over to right side. Hepato-duodenal membrane: ran from proximal gall-bladder and cystic duct to front of first portion of duodneum, causing fixation and angulation at apex of moderate degree. Duodeno-jejunal angle: shows fold of peritoneum running upward and to the left, causing elongation and definite kinking, also compression where the membrane crossed in front of the angle. There seemed to be no other disturbance in the neighborhood. Ileum: negative. Pericolic membrane: covered the whole length of cæcum and ascending colon, causing moderate compression. Upper edge showed firm, large band, causing marked angulation and compression of the hepatic flexure. There were also strong adhesions between ascending and transverse colons about 10 cm. from hepatic flexure. It aggravated the angulation of the hepatic flexure. Appendix: small; quite congested and bulbous near tip. Liver, gall-bladder, pancreas, kidneys: normal. No sign of ulcer in either the stomach or duodenum. Procedure: Mobilization duodenum. Mobilization colon. Mobilization duodeno-jejunal angle (plastic instead of anastomosis). Appendectomy. Convalescence: Uncomfortable. Extremely restless and nervous, asking for narcotics. Discharge from the wound on tenth day, healing completed on the twenty-eighth day.

Result: Three years, six months, improved. Seldom has pain, no constipation. Appetite good, no limitation of diet. Endurance is definitely increased, but still troubled with lassitude. Improved, three years, six months.

Case XLII, D. C., F. Twenty-two years. In good health until seventeen years old, but has always had occasional attacks of lower abdominal pain after over-eating. When seventeen definite attacks of pain occurred every few months; sharp, cramp-like in character, lasting from a few minutes to two hours; rarely associated with nausea, almost never with temperature. These attacks have been getting more frequent, more definite, more persistent. During the last six months she has been confined to bed for a few days with each of three separate attacks which were associated with nausea, vomiting and a temperature of 101.5. During the last six months she has been weak, very nervous, sleepless and almost completely disabled. There is marked flatulence; bowels have always had a tendency to be loose. Periods have always been normal. She has lost much in color; appetite is poor. Physician states she had tuberculous lesion of left upper lobe, which is now healed.

P. Ex.: She is tall, medium weight, well nourished, slightly pale. Lung shows healed lesion. Heart: normal. Rather nervous and irritable. Abdomen: normal in contour, tympanitic everywhere. Distinct tenderness over the appendix region. Slight tenderness over the gall-bladder; marked tenderness in mid-epigastrium. Urine and stools: negative.

X-ray series: Stomach: average size, fish-hook type, no sign of ulcer. Peristalsis: normal. Empty in three hours. Duodenum: apex; standing, at level of lumbar ii; prone, dorsal xii, shows distinct angulation. Cap, small, no deformity suggestive of ulcer. Dependent duodenum: slightly enlarged, no sign of obstruction. Cæcum and beginning ascending colon: markedly dilated. Upper ascending colon and hepatic flexure: high, narrow, sharply angulated. Transverse colon: apparently closely attached to upper ascending colon. Appendix: visualized throughout. Some regurgitation through the ileocæcal valve. Pre-operative diagnosis: Hepato-duodenal membrane. Pericolic membrane. Chronic appendicitis.

Operation: 1-16-19. Incision: T. R. R. Two cm. above navel. Findings: Stomach: appeared normal, no sign of ulcer. Duodenum: fixed high and kinked. Hepato-duodeno-colic membrane: ran from middle of gall-bladder to cystic duct, downward to first portion of duodenum onward to hepatic flexure, which was held high and angulated. Liver and gall-bladder: normal, except for membrane. Duodeno-jejunal angle: showed slight kinking by membrane running across its front and upward to the left. Cæcum and appendix: quite adherent to iliac fossa. Appendix: short, kinked, segmented with bulbous tip. Pericolic membrane: very thick; covered ascending colon from just above the cæcum nearly to hepatic flexure. This caused marked compression of ascending colon, especially at the upper end. Pancreas, kidneys: normal. Pelvic organs: normal, except for right ovary, which was somewhat enlarged, firm and prolapsed. Pathological report: Chronic appendicitis. Procedure: Mobilization duodenum, 5 cm. Mobilization colon. Mobilization duodeno-jejunal angle. Appendectomy. Convalescence: Uneventful, except for extreme nervousness and hysterical outbursts.

Results: After six months has gained fifteen pounds, feeling very well in every way. No pain except following over-eating. Is sometimes troubled with diarrhœa. Very little flatulence. Appetite good, can take almost any food. Has not regained her strength. About one year later she developed tuberculosis definitely and has since been at a sanitorium. Her digestive symptoms were, therefore, much improved during the early part of her post-operative period, but her later troubles have destroyed the value of the operation. Digestive result, after six months. Much improved.

Case XLIX, N. M. A., F. Thirty-six years. For eleven years she has had a great deal of trouble with constipation and some hemorrhoids. By careful attention to diet she got along fairly well. When thirty-three years old she had measles and was quite sick. This attack was followed by digestive disturbances, so that six months later her appendix was removed. When thirty-four years old she began having troublesome pains in the upper abdomen and left chest. No heart trouble could be found, but palpitation was constantly present when her pain was troublesome. Within a few months of the onset of these pains she had a complete breakdown. She has made some improvement, but is still distinctly neurasthenic. Trouble is getting to be more disturbing as time goes on. Bowels are markedly constipated. Now and then she has bleeding from the hemorrhoids and an occasional fissure forms. She has lost a few pounds in weight. From thirty-five on flatulence and abdominal pains have increased very much in frequency and severity and are now aggravated, especially in the right lower quadrant.

P. Ex.: She is of a small size, slender and quite pale. She has the appearance of prolonged suffering. She is almost completely disabled. Heart, lungs, urine: normal. Abdomen: normal in appearance. Shows appendix scar. There is tympany everywhere but it is most marked in the right lower quadrant, running upward toward the hepatic flexure. Cæcum and ascending colon: distinctly dilated, distended and are definitely tender. Moderate tenderness in the mid-epigastrium. Pelvic examination: shows ovarian tumor about 9 x 6 cm. Otherwise pelvic organs seem normal.

X-ray series: Stomach: marked fish-hook type. No sign of ulcer. Lowest border of stomach within true pelvis; marked six-hour retention. Duodenum: apex, lower border lumbar iii, erect; middle lumbar ii, prone. Sharp angulation; cap moderately filled; no sign of ulcer. Descending duodenum: at first narrow, then showing marked puddling of dependent portion. Six-hour retention in duodenum. Hepatic flexure: fixed at level of lumbar ii, showing angulation. Cæcum and beginning ascending colon: dilated. Pre-operative diagnosis: Hepato-duodenal membrane. Duodeno-jejunal angle obstruction. Pericolic membrane. Post-operative adhesion. Ovarian tumor.

Operation: 6-14-19. Incision: Vertical left rectus, below navel. Removal cystic tumor, left ovary, wound sutured. Incision: T. R. R. Three cm. above navel. Findings: Stomach: enlarged, pushed over to left. Duodenum: apex, fixed high and kinked. Hepato-duodenal membrane: from proximal gall-bladder and cystic duct to apex of duodenum. Duodeno-jejunal angle: definitely obstructed. Dependent duodenum: much dilated; 4.5 cm. in diameter. Broad adhesions to old appendix scar. Right edge of omentum crossing lower ascending colon, causing marked constriction. Pericolic membrane: across middle of ascending colon, causing constriction. Pancreas, gall-bladder, kidneys: normal. Pelvic organs: normal except for left cyst. Procedure: Mobilization duodenum downward 3 cm. Mobilization colon. Duodeno-jejunostomy. Separation of adhesions. Convalescence: Uneventful.

Result: Two years. Improved. Still has some pain and flatulence and slight constipation. Color and nutrition improved. Appetite good. General endurance not greatly improved. Improved, two years.

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Reprinted from New York State Journal of Medicine, March, 1922

CERVICAL RIBS: WITH SPECIAL REFERENCE TO THE SURGICAL TREATMENT.*

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THE number of cases of cervical ribs which have been reported has increased rapidly, especially since the radiograph has made it sible to make a definite diagnosis in many in- nces which would otherwise have been obscure. The publications of Keen, Halstead, Church, ssell, Goodhart, Skillern, *et al,* have so fully ered the morphology, incidence, anatomy, hology and symptomatology, that further ex- ded discussion is unnecessary. Nevertheless, vill be useful to recapitulate the facts.

These ribs appear in females as compared to les in the ratio of about three to one. (Keen.)

They are usually bilateral, though asymmetri- as one is usually much more developed than other.

With very rare exceptions they are attached the seventh cervical vertebra.

They vary in size from a somewhat enlarged nsverse process of the vertebra, to a complete which articulates with the vertebra and the rnum. Between these two extremes there are ny intermediate stages of development.

The rib may be joined to the vertebra by a true culation, may be held to it merely by fibrous ue, or may be united to it by bony fusion, the more rudimentary the rib the more likely ony fusion to be the method of union.

When the anterior end of the rib does not ch to the sternum, it is usually attached to the t true rib either by direct articulation between two, or by articulation between the end of false rib and the summit of a bony projection m the upper surface of the true rib. In ier case there may be direct union without presence of a true articulation. In the more imentary ribs there is usually no direct con- t with the first true rib, but there is usually nd, arising from the tip of the false rib, an neurotic band which runs forward and down- rd to an attachment to the first true rib. This has been reported by a number of observers, and occurs in several of the small series herewith reported. This aponeurotic extension causes the same symptomatology as does a false rib of similar extent.

In the presence of these accessory ribs the subclavian artery rises to a higher level than usual in the neck. In those cases in which the false rib is joined to an upward bony projection from the upper surface of the first true rib, the artery is usually found crossing the true rib just in front of the bony upward projection.

The subclavian vein is changed in position only when the false rib is complete and reaches the sternum.

The eighth cervical and first dorsal nerve roots pass up over the false rib to join the plexus. They are usually the first to show signs of traumatism, the results of which are expressed not only by motor and sensory disturbances, but also in a certain percentage of cases, by vaso motor changes because of injury to the sympathetic communicating branches which run with these roots. (See cases 3 and 5.)

Symptoms resulting from the presence of cervical ribs practically never appear before the age of 15 years and may make their primary appearance as late as 55 or 60 years. (Case 3.) In the majority of cases they first appear between 20 and 30 years of age. In many cases the ribs are discovered incidentally and have never caused symptoms.

Various reasons are given for the late appearance of symptoms: the ossification of the rib with resulting increased rigidity, which goes on between 15 and 25 years of age: traumatism, exemplified in the carrying of heavy weights in the hand or on the shoulder which would drag the extremity downward and so increase the tension of the lower nerve roots over the false rib: habitual faulty position, standing with shoulders stooped and carried forward; poor muscular development, or marked relaxation following a debilitating illness, all of which allow the extremity to sag and increase the tension of nerve roots over rib. This last item has been prominent in my small series.

Where the rib is sufficiently developed to share in the movements of respiration with the true ribs, its excursions would add to the nerve traumatism.

In the individual case these factors undoubtedly

*Read at the Annual Meeting of the Medical Society of the e of New York, at Brooklyn, May 4, 1921.

combine in varying proportions to cause the final result.

Symptoms.—Sensory symptoms are usually the first to appear: paræsthesias involving chiefly the ulnar side of the forearm and hand: pains involving the same region or extending over the whole extremity and in a certain few cases radiating also to the neck, ear, shoulder, and even to the intercostal region: in the cases of longer duration hypesthesia or anæsthesia may supervene.

A number of writers have published cases in which dissociated sensory disturbance suggested syringomyelia and in a recent paper Bassoe has again emphasized the fact that true syringomyelia is a not infrequent associate of cervical ribs.

The signs of motor disturbance also develop insidiously, increased fatiguability appearing first and then, gradually, loss of power and atrophy. The atrophy is said to appear first in the thenar muscles, but eventually most of those supplied by the ulnar nerve are involved. In a few cases the paralysis and atrophy are widespread. Claw-hand deformities may result.

Trophic disturbances appear in the more severe cases, usually in the fingers, and are indicated by thin glossy skin, blebs, ridged nails, and even by gangrene more or less extensive.

Vasomotor changes are not uncommon. Swelling, cyanosis, hyperidrosis and coldness may involve the fingers and hand, Case 3, or even extend up the entire extremity, Case 5.

All of the above symptoms may increase slowly and steadily, or there may be periods of remission.

After symptoms have once definitely appeared the probabilities are all in favor of progression, whether it be rapid or slow, steady or intermittent. The severity of the symptoms is not at all dependent on the size of the rib.

The local signs consist of a resistant bony mass in the base of the neck 2 to 3 c.m. above the middle of the clavicle. This often causes a visible prominence. It is usually quite tender to pressure.

The subclavian artery rises higher than normal in the neck. It passes above the rib when it is nearly or quite complete: lies in front and slightly below the tip of the less extensive ribs: and lies over the aponeurotic extension running forward from the tip of the more rudimentary ribs. Varying postures of the arm may modify or obliterate the pulse.

The lung apex usually rises higher than normal. The lower roots of the plexus can be felt more distinctly than usual and are more sensitive to pressure which also aggravates the sensory symptoms already present.

Not infrequently there is a cervical scoliosis. This is occasionally due to a wedge-shaped accessory vertebra with which the rib articulates.

Good stereoscopic radiographs are essent to making the diagnosis. In the case of very ru mentary ribs there is much room for argume as to the permissibility of the diagnosis, and o must then interpret the plates in the light of t clinical findings.

When the process of exclusion has narrow the diagnosis down to that of cervical rib as t cause of the symptoms in a given case the questi of treatment is in order.

A certain number of men advocate non-sur cal treatment over a considerable period of tin This consists in the use of a sling to prevent t weight of the extremity from tugging on t plexus and artery, and the employment of m sage, heat, etc., for the improvement of the c culation and nutrition.

While this treatment will undoubtedly gi relief during its continuance, and may, in ca where the symptoms are very mild, give an a parent cure for a time, it is extremely unlik that any permanent improvement or complete c will be obtained, in a case where the rib has or been the cause of definite symptoms, except the removal of the basic cause.

The objections to surgical treatment are t the operation is difficult, is apt to be quite bloo and is frequently followed for a varying peri of time by more or less paralysis of the extre ty which results from operative traumatism to t plexus.

Were it not for these objections, which a v view of the literature show to be very re there could be no question that operative tre ment should be the method of choice. It remai then, to so perfect the operative technique as minimize or eliminate the causes for the obj tions to operation.

The stage of the trouble at which operation done influences very materially the result. T more pronounced and advanced are the sympto the less likely is the result to be a complete cu

The more the nerves have been damaged the rib, the more are they susceptible to lasti damage from any traumatism at the time operation.

If operation is delayed until more or less thro bosis has occurred in the arteries of the extre ity, then the results must be far from satisfa tory.

Where the condition is complicated by t presence of syringomyelia it may be difficult determine the degree of responsibility of the r in relation to the symptoms, but there can be question that the removal of the rib, if it can done without traumatism to the plexus, is distinct advantage to the patient.

When a complicating neuritis involving the e tire plexus is present it might well be advisal to enforce rest and treatment until the neuri has largely subsided before removing the r

ce operation during the active stage might un-ubtedly cause post-operative aggravation of pain, and the nerves would be more suscep-e to damage in other respects.

Operations for the removal of cervical rib e been classified in three general groups:

. The "anterior," in which the incision is de along the posterior border of the sterno-stoid muscle, thus giving exposure of the nt of the plexus and the cervical rib.

. The "lateral," in which the incision is above l parallel to the clavicle, or runs along the erior border of the trapezius muscle. In either e the exposure permits attack on the rib from lateral aspect of the neck and plexus.

. The "posterior," in which a vertical inci-n is made about 2 to 3 c.m. to the side of and allel to the spinous processes of the cervico-sal vertebræ, giving an approach through the pezius muscle to the posterior aspect of the close to the vertebra.

he first approach involves so much manipula-n of the plexus as to be undesirable.

he second, or lateral, approach is, on the ole, the best.

he third involves cutting through a thick and portant muscle, the trapezius, and the working d is at considerable depth. It gives direct proach to the inner portion of the rib, but ne-sitates working around a corner to get at attachment of the rib to the vertebra and it luring the separation of this part that trouble-ne hemorrhage is likely to occur, and its con-l from behind is difficult.

he fact that there are three groups of proce-res, each of which is advocated by different sur-ons, means that none of them are perfectly isfactory.

he best operation must fulfill the following ditions:

a) The exposure must be sufficiently free to mit complete removal of the rib and the con-l of such hemorrhage as occurs.

b) The attack upon the rib must be from such angle as to involve the minimum manipula-n and retraction of the brachial plexus and roots, since injuries to these cause the most ious sequelæ of the operation.

c) The healed wound should be as incon-cuous as possible. This is quite important since se ribs occur in women, according to different thors, from three to nine times as often as in n.

he following technique has seemed to fulfill requirements and has been used in all but the t of the series of five cases here reported.

he incision starts at the posterior edge of the ertion of the sterno-mastoid muscle into the vicle and passes upward and outward to the rder of trapezius muscle, making an angle of out 45 degrees with the clavicle, Fig. 4.

It may slant either above or below this line according to the conformation of the individual neck. This incision lies right in the natural wrinkles of the skin. After healing it always remains as a fine hair line instead of spreading, after a few months, into a broad ugly scar as do the skin incisions made in other directions in this part of the neck.

When this incision is carried through the skin and fascia, the transversalis colli vessels are tied and divided, the fat pad in front of the plexus is mobilized at its outer edge and retracted inward, and then the brachial plexus is completely exposed. Fig. 1.

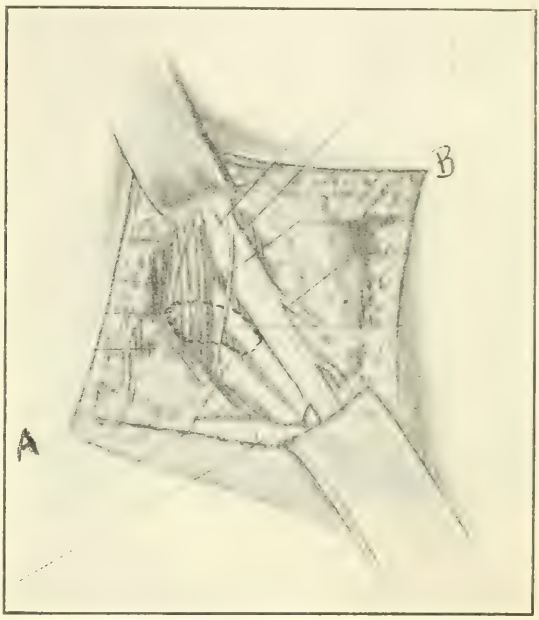


FIG. 1.—Drawing of adult left plexus exposed by incision described. In the average dissection C viii and D i are at a lower level, being almost behind the clavicle.

a. Beginning of incision over the insertion of the sterno-mastoid muscle into the clavicle.

b. The outer end of the incision over the border of the trapezius muscle.

The dotted line figure shows about the position of the rudimentary type of rib which, of course, lies behind the nerves, and, when it is present, is associated with a marked upward arch of the lower roots of the plexus which always pass above the rib.

The cervical fascia is divided along the outer edge of the plexus which is then separated from its bed posteriorly sufficiently to expose the rib and is then very gently retracted forward. This rib is usually higher in the neck than one thinks it is, so that care must be exercised not to mistake the posterior end of the first true rib for it. Where the accessory rib is of good size it is more readily identified, but when it is rudimentary it is often entirely buried in the scalenus medius muscle. In this case it is helpful to locate the prominent carotid tubercle (C vi) and then to feel just below it to identify the rib (C vii).

Once the rib is definitely made out, its muscular and ligamentous attachments are divided by sharp dissection so as to leave all periosteum on the rib.

Great care must be taken to protect the pleura and subclavian artery.

In several reported cases, periosteum, which has been left in situ, has generated new bone and symptoms have recurred.

The last portions of the rib to be freed and removed are the neck and head. These are in the center of the danger zone. The seventh cervical root comes out of its spinal foramen and passes over the neck of the rib at about an angle of 60 to 70 degrees. In the rudimentary ribs the whole thing is apt to be a flat plate of bone extending from the vertebral body outward to or a little beyond the tip of the transverse process and having its edges in the vertical transverse plane, so that its upper edge lies just beneath the seventh root at its exit. In the more fully developed rib, the head and neck are more like the normal and present no sharp edge to the seventh root. These anatomical variations may help to explain the frequently observed clinical fact that the small rudimentary ribs often cause more neurological symptomatology than do the fully developed ribs.

Just in front of the neck of the rib runs the vertebral artery with its plexus of veins, except in the unusual type where the artery enters the foramen in the seventh instead of the sixth transverse process. It is obvious then that the removal of the neck and head causes the chief hazard to the vessels and nerves.

For this part of the work scalpels, scissors and rongeurs with long handles and slender blades are a great advantage. Good illumination is a prime requisite.

After the outer portion of the rib has been dissected free from its attachments it is grasped by small bone forceps and manipulated as convenience dictates while its inner portion is dissected free. Sometimes it is possible to get a clean enucleation of both neck and head, especially when they are held to the vertebra by regular articulations, but frequently, because of troublesome hemorrhage or of firm fibrous or bony union of the head to the vertebral body, one must be satisfied to leave the head of the rib in situ. This has seemed to cause no late disturbance. It is important to remove the rib right up to the head because there might otherwise be continuing irritation of the seventh root. This is accomplished with the slender bladed rongeur.

During all this dissection the plexus must be held slightly forward on a blunt flat retractor with the edges rounded so as to avoid the pressure of any sharp edge on the retracted nerves. The amount of functional loss in the nerves as a result of operation is almost entirely dependent upon the skill, gentleness and continuing thoughtfulness of the assistant holding the retractor. One must make frequent remissions in this pa of the procedure with removal of the retract to avoid too prolonged continuous compressio of the nerves.

Toward the end of the procedure, annoyi hemorrhage is apt to result from injury of son of the veins forming a plexus about the vert bral artery.

Packing controls this type of bleeding in a fe moments.

If, by chance, the vertebral artery should damaged, it would be most unwise to attem clamp and ligature in situ because of risk to t plexus in the necessary manipulations. Ho ever, it would be easy to expose the vertebr artery, near its origin, through the anterior inn portion of the wound, for ligation. In the sar way the inferior thyroid could be ligated if any chance it should be injured.

In the case of ribs which are complete or near so, the portion in front of the plexus can be d sected free and removed. The plexus can th be mobilized, gently retracted forward and sligh ly inward, and then the remainder of the r removed by lateral approach to the rear of t plexus as above described.

In the rudimentary type the entire bone m lie within the scalenus medius muscle which mu be split between its bundles until the tip of t rib is located. It is then enucleated as abo described. In this type there is frequently, if n always, a strong aponeurotic extension runni from the tip and lower margin of the rib forwa and downward to the first true rib or even the sternum. This aponeurosis, being ten causes pressure on the nerves as they pass ov it. It must be thoroughly released from any tachments that hold it taut.

The rib having been removed and hemosta secured, the fat pad is replaced in front of t plexus and the wound is closed without draina by means of interrupted and continuous s sutures which include the skin and fascia. T lips of the wound fall together naturally. Aft a short time the scar is lost among the natu skin wrinkles. Fig. 4.

The above described exposure, then, has t following advantages:

1. It gives a complete exposure of a cervi rib of any degree of development, from the st num back to the spine. It really combines the e posure given by both the anterior and late groups previously mentioned.

2. The risk to the plexus is minimized b cause the attack on the spinal segment of the r is made almost parallel to the posterior plane the plexus and from the lateral aspect so th the plexus needs to be only slightly retracted fo ward. Ribs can be removed without any e dence of traumatism to the plexus. Case 4.

3. Hemorrhage can be controlled either at the ite of its origin or by exposure of the origin of ne artery without increasing the incision.

Case I.

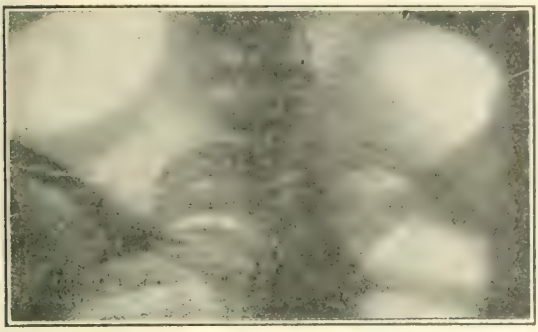


Fig. 4.—Radiogram of Dr. Goodhart's case made be-ore removal of the false ribs. The supernumerary ribs re indicated by arrow heads. Note the greater promi-ence of the left cervical rib. Scoliosis is evident. (The idiogram was made by Dr. L. G. Cole, New York.)

4. No muscles or structures of any importance re divided, except those attached to the rib hich must be divided anyway in order to re-ove the rib. The whole dissection follows nat-ral lines of anatomical cleavage.

5. When the skin edges are released from re-action they naturally fall together, healing is y a fine hair line which never shows a tendency spread and which is lost among the natural in wrinkles. This cosmetic result is of great dvantage to female patients and is gained with-ut any loss in any of the other desiderata of ne procedure.

The Case published by Dr. S. P. Goodhart in Am. Jr. Med. Sc., Nov., 1909.)

Case 1. Mrs. Br.; 28 years old.

In her eighth year she began to have pains the left shoulder radiating down the arm and ttacks of paroxysmal numbness of the entire xtremity. Later there was prominence of the ft shoulder blade, pressure downward upon hich gave rise to pain and numbness in the ex-emity. After a few years there was lessened exterity in the left hand.

When 18 years old placing the left hand be-ind her often caused flexor spasm in the mus-es of the forearm and hand. When 24 years ld there was some weakness of the left hand, ollowed by progressive atrophy of its intrinsic uscles. At intervals, the extremity was cold ubjectively and objectively, especially from the bow downwards. During these attacks mus-ular weakness was increased. Posture did not nfluence these attacks. There was hypesthesia f the inner side of the forearm and hand.

Later there was atrophy of the muscles of ne forearm supplied by the ulnar nerve and also some atrophy of the left pectoralis major. Figs. 6, 7, 8.

Figs. 2 and 3. There was a palpable bony tumor above the left clavicle and a smaller one above the right clavicle. A radiograph showed bilateral cervical ribs, both articulating with a bony prominence on the corresponding first true rib. Fig. 4.

Shortly before the operation the left radial pulse was smaller than the right and could be

Case I.

Fig. 6.—Showing particular atrophy of the interossei of the left hand. (Dr. Goodhart's case.)

Right Case I. Left

Fig. 7.—Showing muscular atrophy of the left fore-arm and hand. (Dr. Goodhart's case.)

Right Case I. Left

Fig. 8.—Showing atrophy of the left palmar muscles. (Dr. Goodhart's case.)

obliterated by gently compressing the subclavian artery against the rib.

There was no edema or cyanosis of the hand on either side. About six months before operation there appeared some weakness of the right index finger, slight numbness in the thumb and lack of dexterity in the use of the hand.

Fig. 4. There was a scoliosis from C vi to D v with the convexity toward the left, which increased the prominence of the left rib which wa also the larger. May 14, 1907. Operation. Ethe anesthesia.

Left side.—Incision from the junction of th middle and lower thirds of the sterno mastoi muscle downward and outward to the outer thir of the clavicle, through skin and fascia. The e ternal jugular vein and the transversalis col vessels were ligated and divided. The fat pa was displaced and the plexus mobilized and r tracted forward and slightly inward exposing th rib, which was dissected free as previously d scribed. The rib was divided at its middle an the anterior half removed. In mobilizing th posterior half, the neck which was rather slend and friable broke allowing the large fragment t come away easily. After some difficulty th head and remnant of the neck were successfull removed.

The prominence on the first true rib was r moved by a rongeur and the bare surface covere by suturing muscle over it. This prominence ha a base about 1.5 x 1 c.m. and was about 1 c.r high. Its summit was rounded and fitted into cup shaped cavity in the end of the false ri It was slightly posterior to the middle of the fir true rib. The false rib and bony prominence we firmly held together by fibrous tissue. There w almost no mobility. The false rib had true art culations with both the seventh cervical boc and the transverse process. Its head and nec were slender and the rib broadened as it e tended forward.

The subclavian artery crossed the first true r

Case I.

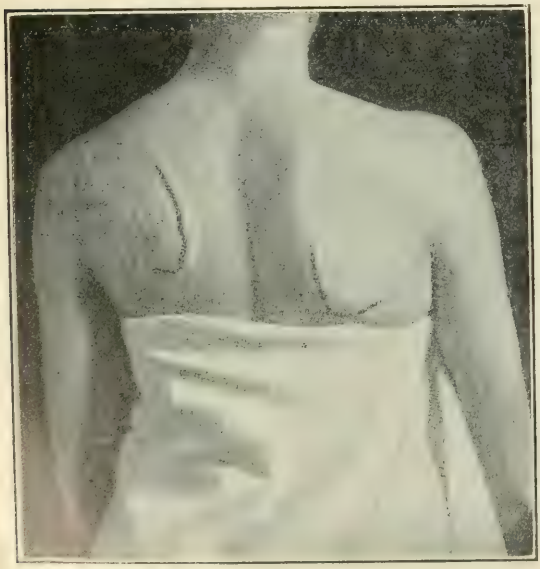


Fig. 3.—Showing the relative positions of the inner and lower borders of the scapulae. The high scoliosis is also evident. (Dr. Goodhart's case.)

Case I.

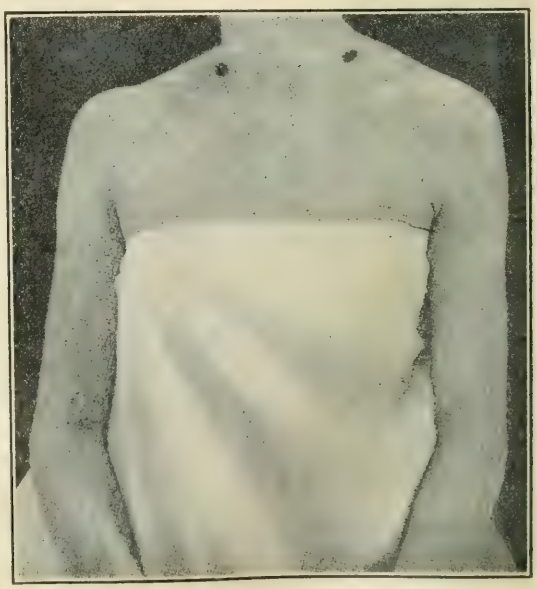


Fig. 2.—Showing the positions above the clavicles which the osseous growths (false ribs) were seen ar felt. (Dr. Goodhart's case.)

ıst in front of the bony prominence and showed
› intrinsic abnormality.

The nerves C viii and D i crossed the false
b near its anterior prominent end and were
ıbject to considerable tension. The roots ap-
eared normal. The other nerves crossed the rib
ithout much apparent tension.

A slip of scalenus anticus muscle was inserted
to the forward end of the rib and an external
tercostal muscle ran from the false to the first
ue rib.

On the right side, a similar procedure was car-
ed out except that the rib was about 2 c.m.
orter and it was not divided but removed in
ie piece except that a small fragment of the
ad was left in situ. Fig. 5. The relation of
e artery and nerves to the false rib was es-
ntially the same as on the left side.

On reacting from the ether she had no feeling
the arms and she had no sense of position.

She could flex and extend the elbows, wrists
ıd fingers but could not abduct the arms.

This was undoubtedly the result of too much
tractor pressure on the outer cord of the plexus.

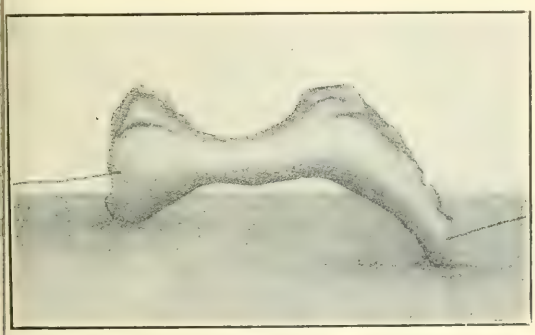


Fig. 5.—One of the false ribs after removal (natural
ze).

After a week sensation was much improved and
e motions were much stronger except for ab-
ıction which was still lacking. It was about
x months before she had recovered to the
uivalent of her preoperative condition.

At the end of a year her right upper extremity
as normal, but there was still atrophy and slight
nsory changes along the inner left forearm and
ie hand.

(*Dr. C. C. Beling*)

Case 2. Louise V.; 22 years.

She was well until she was thirteen years old
hen she had scarlet fever.

At 17 years she had a mastoidectomy on the
ft side.

At 19 years she had a mastoidectomy on the
ght side.

At 20 years she first had a sense of pain and discomfort in the left shoulder and base of the neck. This pain was increased by activity of the left upper extremity. It continued intermittently for about a year and a half and then became much worse in August, 1915. At this time she had much pain at the base of the skull, in the whole left side of the neck, in the left shoulder and inner side of the arm, together with headache and general depression. There was tenderness in all the muscles of the painful area, especially in the trapezius. There was considerable grating when the upper cervical vertebræ were moved. There was no atrophy, paralysis or sensory defect in the left upper extremity (Dr. Beling).

The apparent myositis was treated by heat, massage, etc., for about four months but there was practically no improvement. On the contrary, during this period the pain shot down the inner forearm and hand and there was a tingling, numb sensation also. The extremity became fatigued more easily and there was a slight loss of power.

In early January, 1916, X-ray pictures showed bilateral cervical ribs, of which the left was larger and more pointed. Fig. 9.

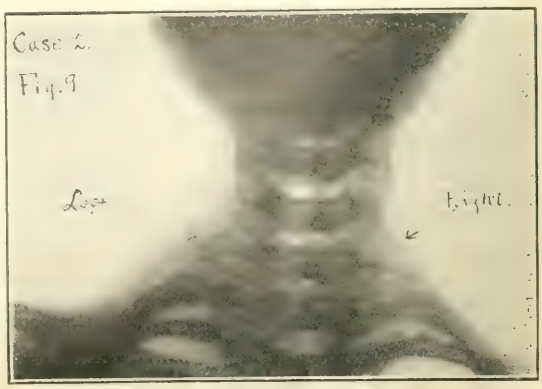
At this time physical examination showed her to be a large, well nourished young woman with ruddy color.

The left cervical rib could be readily felt in the supraclavicular space. The cords of the plexus could be felt as they passed over the rib, and pressure over the point of the rib caused the pain in the back of the shoulder and down the inner side of the arm and hand of which she chiefly complained. There was no scoliosis. (Fig. 9.)

The muscles of the left side of the neck and of the upper extremity were moderately tender to pressure.

There was no abnormality of the circulation or trophic condition of the extremity.

There was no paralysis of any of the muscles nor atrophy of any of the intrinsic muscles of the hand. Nevertheless, the left hand registered 20 on the dynamometer as compared to 35 for the right hand.



There was no loss of sensibility to any form of stimulation.

While she complained of hot feelings in the left side of the neck there was no visible flushing.

Operation January 17, 1916. Ether anesthesia.

In this case the head and neck of the rib were freed by going anteriorly between the roots C vii and C viii as they were sufficiently separated and the approach was easy. The remainder of the rib was freed by the technique already described and the rib completely removed.

Immediately following operation she had pain in left shoulder and chest, and on the fifth day pain began in the left hand. There was no motor paralysis.

There was good primary union.

She left the hospital on the tenth day and returned to the care of her physician. At the end of the first month after operation he reported that a moderate atrophy had appeared in the intrinsic muscles of the hand. At the end of three months this atrophy had entirely disappeared.

On April 22, 1921, five years after operation, she wrote in reply to inquiry that she has had intermittent pain in the left side of her neck and in her shoulder since operation but has never had any more of the numb tingling sensations in the arm and hand. The left extremity has regained its full strength.

Case 3. Mrs. Wm. B.; 55 years.

She has always been frail, but very active and well.

When 40 years of age she first had pain in the left upper extremity which was said to be rheumatic. Since that time there have been several similar attacks of pain but she does not remember any special localization of the pain.

During the last two years the finger joints in both hands have developed swelling and tenderness. During the last six weeks she has had severe pain in the cervical and upper dorsal regions involving both the spine and musculature, increased by motion and associated with marked tenderness on pressure. There was also especially severe pain in the whole left upper extremity, increased by active or passive movement and associated with swelling and cyanosis which were most marked in the hand.

Her condition has been getting steadily worse and there has been such interference with sleep and appetite that she has resorted to morphin.

Physical Examination.—She is a woman of medium height and small frame, who is emaciated, very pale, very nervous, with the left upper extremity carried in a sling. No manipulation of the extremity was possible because of the extreme suffering which resulted.

The fingers were semi-flexed, swollen, cyanotic, extremely sensitive to pressure or movement and showed some enlargement of the joints even beneath the swelling.

The swelling and cyanosis of the hand rendered it impossible to determine the presence or al sence of atrophy of the intrinsic muscles.

The swelling involved only the lower third c the forearm, but the cyanosis involved the extren ity in lessening degree upward. All the tissu of the extremity were very sensitive to pressur except for a definite hypesthesia in the ulna distribution to the forearm and hand.

There was no essential difference between th right and left radial pulse.

The muscles of the cervical and upper dors regions out to the shoulders on both sides wer very sensitive, and the spinous processes wer extremely tender.

The brachial plexus on both sides, especial the roots of C v and V i were exquisitely tende

A hard mass was present on each side of th neck at about the level of the seventh cervic vertebra, pressure upon which caused severe pai

Both subclavian arteries were high in the nec and the visible pulsation was marked.

The right hand and fingers showed slight swel ing and cyanosis with some evidence of arthrit in the small joints.

With the exception of the above disturbanc and slight tenderness of the soft tissues, and pa caused by movement at the shoulder, the rig upper extremity was normal.

The mouth showed marked pyorrhea and number of decayed teeth, with several apic abscesses.

X-ray pictures showed bilateral cervical rib about 3 c.m. long and 2 c.m. wide at the broade part.

This patient was obviously suffering from bilateral neuritis of the cervical and upper dors nerves.

In the presence of a very marked chronic foc infection in the mouth, it was difficult to ascrib so extensive a neuritis entirely to the cervic ribs. However, since the findings in the left u per extremity showed unquestionably that th rib was a positive factor in causing the troubl and in the right extremity the slight swelling an cyanosis of the fingers and hand might well b ascribed to a beginning disturbance by the rig rib, it was finally decided to remove the ribs.

Operation, April 26, 1917. Ether anesthesi

Both ribs were removed by the technique pr viously described.

On the left side a strong ligamentous band ra from the tip and under border of the cervical r downward and forward to the first true rib.

This was divided, and the rib was dissect free.

The rib was very cancellous, friable, and co tained much fat. It broke into several fra ments during removal, but all of it was secure

On the right side the rib was removed in on piece. Unfortunately, no notes were made as the exact relations of the nerves and vessels the ribs.

On the following morning the pain in the left xtremity was much lessened, the swelling and anosis were entirely gone, and the fingers and nd could be moved much more freely than for any weeks past. With disappearance of the velling, atrophy of the intrinsic muscles of e hand was obvious.

There was loss of movement in the right hand id arm for two days, after which there was eady improvement.

The pains in the neck and back were much less id although they varied from day to day they ere never so bad as before operation.

On the fourth day she sat up. Her pains were pidly diminishing.

On the eleventh day she returned home, hav- g had almost no pain for three days, having veloped a fair appetite and feeling much bet- r in every way.

She could abduct the shoulders 30 degrees.

She could flex and extend both elbows nor- ally.

She could pronate and supinate both forearms rmally.

The right fingers and wrist could be flexed most completely but with little strength: they uld be extended not quite to the straight posi- on. The left hand and fingers moved much ore freely than before operation. There was ll present the paralysis of the intrinsic mus- es supplied by the ulnar nerve. The swelling d cyanosis had never returned and the general nderness to pressure in the soft tissues had most disappeared.

Two days after returning home and resuming me of her household duties there was a recur- nce of her pain, swelling and cyanosis.

She then went to a sanatorium for the treat- ent of her neuritis.

On April 20, 1921, four years after operation, e returned to the city for examination, stating at for several years she had been free from in and had been able to do her knitting, sew- g, housework, etc., comfortably and satisfac- rily.

Meanwhile her mouth had been put in good ndition.

Examination showed her to be still very thin d rather pale.

The scars of operation were almost invisible.

There is a marked atrophy and almost complete lsy of the muscles supplied by the right ul- r nerve, so that the right hand shows a fairly pical "main en griffe." Curiously, there seemed be no loss of sensation in the ulnar area, but ther a hyperesthesia to pin prick in that area well as in the rest of the hand and forearm. he motion at the wrist, elbow and shoulder were rmal.

The left hand shows slight atrophy of the enar muscles, especially those supplied by the median nerve. There has been partial recovery of the interossei muscles.

There is slight hyperesthesia of the hand and forearm.

The movements of the fingers of both hands are hampered by the chronic arthritis noted before operation.

The right index finger is subject to frequent spells of blanching, numbness and coldness, otherwise the hands and all the fingers are normal in color and warmth.

The brachial plexuses are only slightly tender.

Case 4.

Miss May C.; 21 years.

She was always perfectly well in every way until 2 years ago when, after an automobile accident, her car was towed home and she had to control it by the emergency brake for a period of 45 minutes.

The car was heavy and the strain on the right arm was great and almost continuous.

On arriving home she had "pain and numbness" in the right upper extremity, and could not move the right shoulder without greatly increasing the pain.

After a few weeks the pain lessened but never disappeared. It was increased by using the arm.

About 8 months ago she developed left mastoiditis and after operation the pain in the right upper extremity increased.

Seven months ago she first noticed atrophy of the thenar eminences, and beginning loss of power in the hand and forearm.

For the last three weeks has had pains in the left upper extremity after using it vigorously.

Physical Examination.—She is a young women of medium size and in perfect health, except for her upper extremities. The right upper extremity shows hypesthesia and hypalgesia everywhere, except over the inner arm (nerve of Wrisberg), especially in the area of the ulnar nerve.

There is diminished sensation to deep pressure over the muscles.

There is great loss of power in the hand grip; atrophy of both thenar eminences, well developed. All movements are present in the extremity, but the power is much diminished.

The right plexus is very sensitive to pressure.

There is no evidence of circulatory disturbance.

The left upper extremity shows nothing abnormal.

The supraclavicular muscles are very well developed and there is considerable subcutaneous fat, so that palpation cannot make out the cervical ribs clearly.

The X-ray picture shows bilateral cervical ribs of moderate size, 2.5 x 1.5 c.m., the widest portion being near the spine, and then tapering to a point externally.

November 12, 1917. Operation under ether anesthesia.

The technique on both sides was as described above.

On both sides a portion of the head of the rib was left. The ribs were very thin and cancellous; the edges were sharp and the tips were just beneath C viii and D i.

For two hours after operation there was numbness in both hands.

Two days after operation the right hand was much stronger than before, and sensation was improving.

On the seventh day she returned home, out of the city. Power and sensation were rapidly improving in the right extremity.

She passed out of observation, but three months later her mother reported by letter that she was perfectly well and able to use both arms freely, vigorously and without pain.

(*Dr. Boorstein*)

Case 5. Mr. Max K.; 22 years.

He has usually been perfectly well. He had influenza in 1918 and in the fall of 1919 had dyspnœa and precordial pain for a short time.

Toward the end of March, 1920, he noticed that the right upper extremity had become very much larger than the left, that it was often cyanotic, especially in the cold, and that it felt colder both subjectively and objectively than the left. It tired very quickly under any sustained effort, but otherwise did not seem to have lost strength.

Only once did he feel any tingling sensation and then it involved only the tips of the index, ring and middle fingers. He never had real pain.

Physical Examination.—He is a tall, slender man of good color, and fairly well nourished.

General examination shows nothing of interest.

The right upper extremity shows an increase in circumference over the left by 3.2 c.m. in the middle of the arm, 2.8 c.m. in the forearm, and 1 c.m. in the hand. Its superficial veins are twice as large as on the left side and the color is distinctly cyanotic. It did not pit on pressure.

It shows no atrophy, no sensory disturbance and no loss of power except easier fatiguability.

In the right side of the neck there is a distinct bony prominence about on a level with the transverse process of C vii. Just below and in front of this prominence is the subclavian artery which is well above the level of the clavicle. The cords of the plexus can be felt distinctly above it and pressure on the lower one over the end of the prominence causes tingling in the inner fingers.

The X-ray plate showed enlarged transverse processes of C vii, which extended on the right side well beyond that of D i or C vi, and was quite broad vertically. As it had no facet, the roentgenologist reported that it was not a cervical rib. Fig. 10.

There was no scoliosis. Fig. 10.

Inasmuch as the clinical diagnosis pointed obviously to cervical rib, and the transverse process of C vii was unduly large it was decided to operate.

Operation, June 18, 1920. Ether anesthesia.

The rudimentary rib extended about 0.5 c.m. beyond the posterior tubercle of the transverse process and was a broad plate of bone which extended downward almost to the neck of the first true rib.

From its tip and lower border strong fibrous bands stretched forward and downward to the first true rib.

The false rib was dissected free and then removed by rongeur, with the exception of a small portion of the head.

Case V.

Fig. 10.—The good plate having been lost, this inferior plate had to be used. The relation of the rib to the transverse processes of D i, are indicated by the rough outlines. The rib on the right side extended slightly beyond the transverse process of D i.

C viii and D i roots passed up over the ligamentous extension of the cervical rib but did not appear to be under tension or pressure. The subclavian artery also did not seem to be under tension.

After operation there was numbness of the whole extremity with considerable loss of power especially in the shoulder muscles.

There was tingling in the fingers, especially the thumb, index and middle fingers.

Tactile sensibility was much diminished.

On the second day the congestion and cyanosis had almost disappeared and sensation and power began to return.

Between the eighth and twelfth days he had several attacks of sharp pain. Aside from this his convalescence was uneventful and rapid.

On the twenty-fifth day he returned for examination.

The right upper extremity was normal in color and temperature. The veins were still slightly

larged, but were much smaller than before eration.

The right upper arm is only 1.2 c.m. larger than e left as compared to 3.2 c.m. before operan, and forearm 0.3 c.m. compared to 2.8 c.m. Motion is free in every direction but there still very slight loss of power. There is slight pesthesia of the index and middle fingers of ve type.

The scar was a slender line. Fig. 11.

Case V.

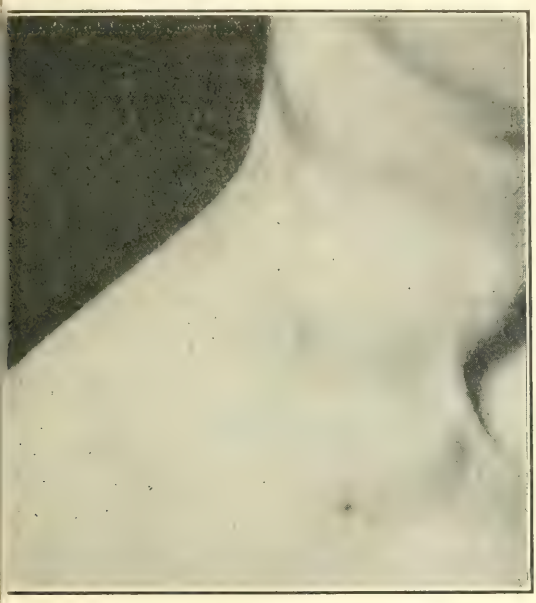


Fig. 11.—The ultimate hairline scar, which scarcely ws when the skin is not stretched, being lost among natural wrinkles.

He was not seen again for about four months which time the extremity was normal and s so remained to the present time.

While this series of cases is small certain sugstive deductions may be drawn from the group. The early symptoms are apt to be mild, someiat indefinite, long drawn out and likely to be ributed to neuralgia, rheumatism, etc.

The symptoms are likely to be started, or markly aggravated by some preceding debilitating iess (Cases 2 and 5), or traumatism (Case 4).

Very rudimentary ribs are quite capable of ising serious symptoms (Cases 2, 3, 4 and 5). Case 5 the roentgenologist refused to accede to e diagnosis, yet the removal of the "enlarged insverse process" caused the rapid and comete disappearance of the symptoms. While veral authors have stated that symptoms are ore likely to be caused by the rudimentary ribs, in by the more complete ones, no explanation s been given for this apparent paradox. The conformation of the rudimentary ribs in this series suggests the reason. Inasmuch as they are broad, flat and thin and set up on edge in front of the transverse process, the nerves passing over them (especially C vii, which must pass directly over the rib in its exit) are much more likely to be irritated and compressed than they would be in passing over a more complete accessory rib which usually assumes the rounded form of the true rib. In addition the rudimentary ribs are very apt to have a forward aponeurotic extension which also presents a sharp-edged resistance to the overlying structures.

Where symptoms have existed over a long period, and especially where paralysis and atrophy form part of the picture, removal of the rib will stop the progressive increase of the symptoms, but may not result in the entire recovery of what has already been lost. (Cases 1 and 3.)

This indicates the necessity of early diagnosis, and the desirability of good stereo-radiographs of the neck in every case of persisting pain or lameness of obscure origin.

When cervical rib, causing symptoms, is associated with a complicating neuromyositis (Case 2), or neuritis (Case 3), probably resulting from chronic focal infection, the removal of the rib will dispose of the symptoms directly due to it, but will only indirectly influence the symptoms of the complicating disturbance. The time at which operation might best be done in these cases can be determined only after comparison of the results in a considerable group in which operation is delayed until the complicating disturbances have largely subsided with those in another group in which operation is done regardless of the associated disturbances. In Case 2 the operation relieved the symptoms due to the rib and caused no aggravation of the symptoms due to the neuromyositis, which symptoms largely disappeared in due time. In Case 3 there was an entirely unexpected, almost immediate, temporary relief of the widespread neuritic pains, as well as immediate relief of the swelling, cyanosis, and loss of power in the left arm and hand. The neuritis, recurrent after her return home, required nearly six months of treatment before recovery occurred. At present it is somewhat difficult to properly allocate the existing defects to the ribs, the neuritis, and the arthritis of the finger joints as causative factors.

Cervical ribs may be removed without the operation causing any additional damage. (Case 4.) In some instances there is evidence of operative traumatism but it is of very temporary duration. (Cases 2, 4, 5.)

A well-placed incision, a lateral attack working behind the plexus, and especially a careful, gentle, intelligent assistant holding the plexus-retractor give assurance of freedom from undesirable operative sequelæ, and the resulting scar will be

scarcely visible among the natural wrinkles of the neck.

If these be facts, then cervical ribs should be removed before they have caused symptoms for any considerable length of time.

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BROOKLYN EAGLE PRESS

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
DECEMBER, 1920.

THE WAR'S CONTRIBUTION TO CIVIL SURGERY*

BY BURTON JAMES LEE, M. D.
OF NEW YORK, N. Y.

PUBLISHED and oral testimony as to the soundness and efficacy of certain new lines of surgical treatment seems to have failed to make its full impress upon the majority of American surgeons. It is highly desirable, therefore, that such a group as ourselves should seriously consider various phases of the surgery of war, inquiring what, if any, application may be made of the knowledge gained, placing this society on record as to its convictions and its practice. Has surgery acquired nothing, leaving its theory and practice just where it was when the war found it? I am of those who believe that a great deal has been given by the war to surgery. This paper represents an effort to find the mind of The New York Surgical Society as to the applicability of certain of the war surgical methods to civil practice. No attempt has been made to cover the whole field, but a certain limited number of topics deemed the most fruitful for discussion have been considered. The following letter and questionnaire were sent to every active member of the Society, numbering seventy, forty-four responding:

DEAR DOCTOR:

I am conducting an inquiry in an effort to find to just what extent certain principles recognized as efficient in the War Zone are being used in civil surgery. If you would be kind enough to answer briefly the enclosed questionnaire I would be very grateful.

I am hoping to make a summary of the questionnaire answers in a paper to be read before the Society in January. Will you, therefore, respond at the earliest convenient moment.

Sincerely,

QUESTIONNAIRE

1. To what extent do you practice primary closure of compound fractures of extremities? Do you approve the principle?
2. To what extent do you use the principle of secondary closure of soft-tissue wounds? Do you approve the principle?
3. To what extent do you use the Carrel-Dakin solution and technic? Do you approve the principle?
4. To what extent do you use the principle of immediate active mobilization in post-operative joint conditions? Do you approve the principle?
5. To what extent do you use the principle of active mobilization in septic joints? Do you approve the principle?

A summary of the various replies to these questions presents the following results:

* Read before the New York Surgical Society, January 14, 1920.

1. To what extent do you practice primary closure of compound fractures of the extremities? Do you approve the principle?

Five men absolutely opposed the use of this principle. The majority favored its employment in properly chosen cases, and several successful results were reported. In general, considerable wound contamination or extensive muscle injury were considered contraindications to the use of primary suture, and when considerable time had elapsed from the receipt of the injury, caution should be exercised in deciding for primary suture. Some men favored not opening the wound where compounding was small and from within, but others seemed to feel these were above all others the cases to open, as being most favorable, and the writer agrees with the latter opinion. Careful *débridement* of all soiled and devitalized tissues was recognized as essential to a successful result, such dissection including cleaning of the bone-ends when soiled. Several preferred to always make use of Carrel-Dakin wound treatment followed by delayed primary or secondary suture. All agreed that when in doubt as to the dissection having been successful in obtaining a clean wound, primary suture had best not be employed. The more accurate one's *débridement,* however, the less doubt there will be in the surgeon's mind as to the degree of wound disinfection accomplished.

We may then fairly conclude that the practice of primary closure of compound fractures is sound and that the principle is approved, but that the cases should be carefully selected and the surgery well done to achieve success.

2. To what extent do you use the principle of secondary closure of soft-tissue wounds? Do you approve the principle?

The writer has made no attempt to differentiate sharply between delayed primary suture (six to eight days) and secondary suture (any time later) as to indications or technic, as these have been completely discussed in the war literature.

With one exception, there was absolute unanimity in favor of secondary suture and the principles underlying its use, this decision, however, being conditional upon having in hand a Carrel-Dakin supply and technic beyond criticism. The exception noted made use of the procedure "only to avoid subsequent cicatricial contraction."

The Society as a whole, therefore, places itself on record as almost unanimously favoring secondary suture.

3. To what extent do you use the Carrel-Dakin solution and technic? Do you approve the principle?

There was but one viewpoint concerning this question, and that an enthusiastic one for the principle and use of wound sterilization by the Carrel-Dakin technic. The only differences of opinion were those as to its scope, and all appreciated the difficulties of obtaining a faultless technic. The Society is apparently unanimous upon one point: only the accepted technic or none at all. Culture control and bacterial charts are

essential to the proper use of the method. It was very gratifying to receive such statements of approval as the following: "As one who has witnessed the transition from antiseptic to aseptic surgery twenty-five to thirty years ago, I regard the demonstration of the fact that septic wounds can be sterilized without damage to the tissues, as the greatest contribution to surgery that the war has made. I do not understand why many able surgeons do not recognize the *new* principle involved in the Carrel-Dakin treatment"; also, "I use the Carrel-Dakin treatment in practically every case of infection." "I look upon the treatment as one of the great advances in surgery"; and, "one of the most important additions to modern surgery."

Certain special points of interest were brought out in the questionnaire.

a. Two large hospital services have practically abandoned the use of the technic because it seemed impossible to provide proper apparatus and solution, and technical difficulties seemed insurmountable. I believe that this Society should stamp any general service where the technic cannot be applied for the reasons stated as not measuring up to the standards of first-class surgery.

b. Two men whom I presume have had but limited experience with the Carrel-Dakin technic felt that surgery alone or surgery plus moist saline dressings gave equally good results. I can only say that experience with a real Carrel-Dakin technic will be the only convincing argument needed for their conversion.

c. As to its use in intra-abdominal abscess cavities, the Society's opinion was divided.

The New York Surgical Society is, therefore, almost unanimously for wound sterilization by the Carrel-Dakin method done properly, and the hospitals of this city must provide apparatus and accurately made solutions, and the surgeons must insist upon faultless technic, that the method may be really available. Following proper surgery, it may, therefore, be used in—

Compound fractures which are unsuitable for primary closure.

Lacerated wounds of soft tissues.

Acute cellulitis.

Osteomyelitis, and

Empyema.

The Carrel-Dakin technic is perhaps the greatest contribution of the war to civil surgery, and it is applicable to numerous groups of cases, both as a prophylactic against infection or to accomplish wound sterilization in the presence of established infection.

4. To what extent do you use the principle of immediate active mobilization in post-operative joint conditions? Do you approve the principle?

The writer, in September, 1918, and again in June, 1919, endeavored to bring home to American surgeons the full significance of Willem's joint surgery, and other writers have added their testimony, but many here in

America still seem ignorant of its principles. Willem's method of immediate active mobilization is thoroughly applicable in civil surgery. It may be used in most of the surgery upon clean joints, such as for movable cartilage of the knee-joint or excision of a small fractured carpal bone or after a traumatism with penetration of a joint, or even, with caution in fracture of the patella. It may also be employed successfully in intra-aritcular fractures without separation and of slight extent. Its use is contraindicated, however, when joint fractures are extensive, or with tendency to displacement, and also in tuberculous joints. The measure then should be applied with judgment.

The motion should be *active* and *immediate* and *frequently repeated.* After the treatment has been instituted, the active motion must be carried out at two-hour intervals in the presence of a nurse or doctor, and the patient is wakened two or three times during the night and encouraged to move the joint.

Two of the members favored passive, rather than active motion, but Willem and Delrez have shown that the latter traumatizes joint tissues less than the former and the degree of pain guides the patient to the limit of active mobilization. *Immediate* active motion may be interpreted to mean any time within the first six post-operative hours, for it is sometimes impracticable to begin earlier, as the patient may hardly be in condition to accomplish much that is really worth while. *No splint* is applied. The dressings over the joint should be loose and no larger than are necessary to insure wound protection and allow for drainage absorption. When feasible, the use of adhesive straps assures the least possible limitation of motion. A tight, large dressing makes any degree of active mobilization impossible. With a knee-joint operated upon for movable cartilage the patient is up and about the ward with crutch support upon the fourth post-operative day and restoration of function may be accomplished in about three weeks.

The results obtained abroad, in those hospitals where the principles were carefully followed through, gave excellent results and justified the enthusiasm of Willem, Delrez, and others for it. Some of the members seem to be wavering between doubt and disapproval as to the efficiency of the method, but experience with the measure must convince them.

It may be said, then, that the majority of the members of this Society are in favor of Willem's method, in dealing with clean joint operations.

5. To what extent do you use the principle of active mobilization in septic joints? Do you approve the principle?

When Willem's method is applied to suppurating joints we have a traditional established mode of treatment thrown rudely into the discard. Many surgeons cannot believe that moving an inflamed septic joint will help the condition and frequently cure it. Some stand aghast and will not or cannot believe. Ten of our members are absolutely opposed to the use of this principle, and a few quotations will illustrate their attitude.

"To my mind to move an active suppurating joint is to add insult to injury. Drainage, rest, and proper local treatment seem to me to be imperative."

"This does not appear to me as reasonable while the process is active nor even when the process has become subacute. After the acute infection has been brought under control and also the swelling and local heat have gone away, then I believe in limited motion every day."

"Not until activity of infection entirely subsided."

"We have had no extended opportunity to practice this type of case. I am not convinced that the principle is sound."

"No experience would doubt its general applicability."

"I confess, however, to a certain amount of fear."

"I would move the elbow in all cases, but not the hip or the knee."

Willem recognized that the only adequate drainage of a septic joint is accomplished by moving it and continuing to move it, lateral openings being the ones usually employed. Active motion will really give the best possible drainage, while immobilization, drainage tubes, and irrigation cannot accomplish this result. I have seen many men with suppurating knees walking about the wards at La Panne with normal knee-joints as regards function and perfectly painless joints, with a thin stream of pus running through the dressings covering their joint wounds and down their legs. These cases were impressive and absolutely convincing. The method is sound, and the experience in practicing it has furnished the proof. It represents a distinct advance in the treatment of septic joints, and it is thoroughly applicable to civil surgery.

The result of our inquiry, therefore, has shown that these types of treatment considered, representing a part of the war's contribution to civil practice, are heartily approved by the majority of the membership of the New York Surgical Society. Only by a thoughtful assimilation and application of such knowledge as the war has developed may the science of surgery truly progress.

THE MODERN CONCEPTION AND TREATMENT OF SHOCK.*

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We cannot be expected properly to define shock when physiologists themselves disagree concerning its essential features. Explanations of its exact nature are numerous and almost wholly at variance, one with the other. The acapnia theory of Henderson has few supporters, and many valid arguments have been presented to disprove the idea that a CO_2 deficiency in the blood properly explains the producton of shock. Porter assigns fat embolism as a frequent causative factor, but clinical experience and experimental work will not permit this theory to stand unchallenged. The exhaustion of nerve cells, supported by Crile, may be a primary factor, but more often is considered a secondary phenomenon. On the other hand, the work of Cannon and Bayliss, during and after the war, as well as the experimental evidence of Erlanger, Gasser, Mann, Dale, and others seem to furnish the best hypothesis of the true nature of shock. They conceive of shock as produced by trauma, with a loss of blood volume as the essential primary phenomenon, and it is mainly upon their work that the modern conception of shock has been developed. Henderson himself early called attention to the importance of a loss of blood volume in shock, and Crile has also emphasized this symptom. Meek and Gasser have pointed out that, in shocked animals, the loss of blood volume, which finds its expression in a lowered blood pressure, may be measured with fair accuracy in the following manner:

A known quantity of gum acacia is introduced into the circulating blood, and ten minutes later the percentage of acacia in blood withdrawn from the animal is determined, and also the amount of blood. A loss of blood volume may also be measured by an increased capillary red cell count and hemoglobin determination. They found in shock a reduction of blood volume of 20 per cent. Keith, in the study of 29 wounded men, made an estimate of the reduction in blood volume by the injection of a dye, and compared his results with those obtained in a series of normal men. He found in the presence of well-developed traumatic shock a blood volume of 51 to 85 per cent. in comparison with a normal volume.

As pointed out by Cannon, and confirmed by Dale's experimental work, the loss of blood volume sustained in shock is unquestionably due to a so-called exemia, or blocking of the small venules and capillaries with red cells, with probably also a certain migration of these cells through the vessel walls.

The associated acidosis present in all cases of traumatic shock is certainly not the cause of the lowered blood pressure, but rather results from the diminished oxygen-carrying power of the blood itself, due to a poorer circulation and circulating medium. The symptom is, however, one toward which proper therapeutic measures should be directed.

I shall, however, dismiss any further theoretical considerations, endeavoring to make this paper a short study of the symptoms of shock, as we see them presented, and the most effectual, practical means of dealing with them.

Hemorrhage and toxemia often produce a group of symptoms closely resembling those of traumatic shock. In the experience of war as well as of civil life these two elements of hemorrhage and toxemia often are associated with traumatic shock, and the whole picture may be a rather complicated one. It is possible in most instances, however, to make a proper differentiation of the symptoms produced by these two conditions from those dependent upon true traumatic shock.

The train of symptoms which we all recog-

*Read at the Thirty-first Annual Session of the New York and New England Association of Railway Surgeons, October, 1921.

nize as those of traumatic shock are: apathy; later sometimes restlessness; blanching of the face; a cold, clammy perspiration; lowered temperature; rapid and shallow respiration; rapid, soft pulse; and a lowered blood pressure. The war furnished an opportunity, which decades of civil surgery could not have done, to study at close range the patient in shock and to determine the efficacy of various forms of treatment. So important did the problem of shock become in the treatment of the wounded man that "shock wards" became an integral part of every hospital service. "Shock teams," consisting of a physician and several trained nurses, were assigned to this work, and various measures were employed in numberless cases, until finally something akin to a standardization was reached in the treatment of shock. Civil surgery presents many similar problems, but we are rather prone to forget the lessons learned from the war and often perhaps fail to apply them.

A matter of prime importance in the treatment of shock is its prophylaxis.

It was soon realized that many more men could be saved if proper preventive measures could be applied to the wounded man as soon as possible after the receipt of his injury. Consideration, therefore, of the treatment of shock must include its prevention, and I shall endeavor to emphasize its prophlaxis as well as its treatment.

1. *Heat.* Recalling that every shocked man has a body temperature below normal, all armies early appreciated the necessity for providing warm clothing for the soldier in the field. In some active sectors exposure to cold and wet was inevitable, and the wounded man often would lie out in the open for hours and sometimes days before the cessation of shell fire would permit his safe removal. Stretcher bearers were taught that cold could come from beneath as well as from above, and they were instructed to make an application of blankets which would give as many layers beneath the man as above him. At the dressing station, as his wounds were dressed, he was warmed, and various simple devices were made use of to accomplish this. The stretcher was placed across the saw-horses, with blankets dropping from its sides to the ground, forming a heated chamber beneath him, the source of heat being a small kerosene stove. Another effective means for providing heat was accomplished by placing the stretcher over the cot, forming a chamber between the two. In this instance the source of heat was a small lamp or stove at the foot of the cot, heat being led into the chamber described by an improvised chimney made from sections of large butter cans readily available at the front. At the triage, or sorting-station, hot drinks were provided, largely through the efficient aid of the Red Cross service, and this permitted the introduction of considerable additional heat.

The British service early furnished warmed ambulances for the evacuation of the wounded, the source of heat being the exhaust pipes of the engine, in this way maintaining a constant warmth until the evacuation hospital or the casualty clearing station could be reached. In our own service no such warmed ambulances were provided. At not infrequent occasions I removed dead men from an ambulance after a long evacuation on a cold night, and I have a definite impression that death had been largely contributed to by the prolonged exposure to cold.

Is it not possible with our traumatic cases in civil life to have a proper blanketing of the patient? Is the ambulance surgeon of today instructed as to the proper method of blanketing? Do we provide some simple means for maintaining a constant warmth for the patient until the hospital is reached? Are we not more apt to load the man hastily onto a stretcher and place him in a car for a long ride to the hospital without considering the loss in bodily temperature which may

ensue, with a consequent increased liability to shock?

2. *Trauma.* In the early months of the war, the cases of compound fracture reached the surgical hospital in a condition of profound shock. As the true relation of trauma to shock came to be appreciated it was realized that the traumatization of muscles by the movement of fractured bone ends during a long evacuation was a very important factor in the production of shock. The use of the Thomas splint for fractures of the extremities soon became an important part of the equipment of every forward hospital and every ambulance dressing station, and the enlisted men of the medical service in every army became very efficint in the rapid and correct application of this splint, giving a traction on the extremity which was adequate to immobilize the fractures ends. From the inception of the efficient use of the Thomas splint the vast majority of cases of fractures of the long bones reached the surgical hospital in a satisfactory condition, few of them exhibiting any marked symptoms of shock. Has the lesson learned abroad been made full use of here at home? Is the Thomas splint used often in railway emergency services, or do we still place a long, wooden splint, with no opportunity for traction, along the injured leg, forgetting the possible traumatization to adjacent muscles during the journey, in a train, to the hospital? Would it not be possible to have the Thomas splint provided as an essential part of the first aid equipment in every train in the country? Would it not be possible to furnish first aid instruction for selected trainmen which would permit the reasonably efficient application of such a splint to a fractured extremity until the services of a surgeon could be secured?

3. *Morphine.* A small dose of morphine given as soon as possible after the receipt of the trauma acts as a prophylactic against the development of shock, by diminishing the response of the centers in the central nerves to the efferent impulses.

Although at the time of the receipt of the trauma little pain may be experienced, later on the traumatized patient often suffers a certain degree of pain, accompanied by more or less restlessness. Abroad, every enlisted man in the medical service was provided with "Greeley units." This unit consisted of a sterilized, tinfoil container carrying one dose of morphine in solution, with a needle attached, which was covered by a closed screw cap. It was possible to thus administer hypodermatically a quarter grain of morphine within a few seconds, the cumbersome method of dissolving the tablet and the use of the ordinary syringe being completely discarded. It would obviously be impossible, with our present narcotic laws, to make a general use of the Greeley unit here, but certainly the emergency railway surgeon could administer morphine to a number of injured patients in a much more efficient and expeditious manner by the use of the Greeley unit than by any of the older syringe methods. However, the general experience abroad established the unwisdom of excessive morphinization. Would it not be possible for the railway surgeon to be provided with a series of tags similar to those used abroad for the wounded men, upon which might be registered the dose of morphine given and the time of administration, so that no error of overdosage might be made during the transit of the injured man to the hospital?

4. *Restoration of Blood Volume.* A systolic blood pressure of 80 millimetres of Hg. or below is generally considered as definite evidence of a condition of shock. A consistent rise in blood pressure following any means of therapeusis is a fair indication that the blood volume has been increased toward normal limits. Intravenous infusions of normal or hypnotic salt solution are ineffective in the restoration and maintenance of blood volume. Following the use of such an in-

fusion the blood-pressure readings show a rapid decline beginning shortly after the injection of the agent. Hypodermatoclysis gives a rather better response, but the increase of blood volume is not great and the method is ineffective if a state of profound shock exists. Rectal instillations of any solution assist in the restoration of blood volume, but these will not suffice to completely restore the normal volume of blood in a condition of profound shock. All of these measures, therefore, may serve as temporary adjuvants, but cannot be relied upon in the treatment of well-developed shock.

Transfusion of whole or citrated blood furnishes the best means for a restoration of blood volume. This statement is true whether a patient is suffering from traumatic shock or acute anemia following hemorrhage, or both. Unfortunately, blood is not always available. I shall not discuss blood transfusion at length, but wish merely to refer to the following practical considerations: 1. Every emergency surgeon should familiarize himself with Vincent's macroscopic grouping test. This method was used abroad to the exclusion of all others, and became a routine procedure in every hospital of the American service. The method makes the grouping of any possible donor the matter of a few seconds, for all the materials needful are containers of group 2 and 3 serum, a glass slide and a needle. A hospital receiving considerable numbers of traumatic cases should always have constantly on hand a list of available donors whose grouping has been previously arranged. Under these conditions the determination of the group of the recipient is all that is required to satisfy the surgeon of the compatibility of the bloods. 2. In civil surgery there seems to be a tendency to defer transfusion to the last moment. If it is to be of any avail at all, it is of service early and must be employed without delay, if the best results are to be obtained. As a life-saving measure it certainly stands in the front rank, and the simplest form of apparatus for carrying out a transfusion should be in the hands of every railway surgeon in the country. 3. The technic proposed and developed by Lewisohn with the use of citrated blood, because of its simplicity, is the method of choice. If the bloods are properly grouped, the reactions following such a transfusion are never alarming and never fatal.

A 7 per cent. solution of gum acacia in saline solution was first suggested for intravenous use by Bayliss in 1917. Both he and Cannon advocated its use in cases of profound shock or even as a substitute for blood following serious hemorrhage. The loss of blood volume suffered by the shocked patient was thereby overcome, the blood pressure was raised, and the oxygen-carrying power of the blood from the improved circulation was thereby definitely increased. In the British service this solution of gum acacia was used with considerable success. In our own army, about the middle of 1918, the Department of Laboratories at Dijon prepared a gum acacia solution which was sent to all forward hospitals for intravenous injection in cases of profound shock and hemorrhage. The transportation difficulties were acute; it was sometimes days before the acacia reached the forward hospitals; and frequently the solution was kept for a further period of time before its injection into the patient. The solution thus furnished had certain elements of instability. Certainly, the administration of the gum acacia as practiced in many of our forward hospitals yielded very unfavorable and several fatal results, and in most of the front hospitals its use was discontinued. In a previous article I advised against the use of gum acacia in the treatment of shock as a substitute for blood in hemorrhage. A review of the reasons for the disasters in the American service, in the light of experiences with the gum-glucose solution advised by Erlanger, Gasser, et al., as well as by Cannon, leads me to believe that an unstable solution and

faulty, as well as a too rapid administration, probably contributed to the unfortunate results obtained abroad. The finished work of Erlanger and his co-workers on this whole subject, with further clinical data furnished by Ward and Farrar, and the recent work done at the New York Hospital in the Brady Institute by Lowsley, has led to the conviction that gum-glucose, properly prepared and properly administered, may be one of the most effective means in the hands of a surgeon to combat traumatic shock. The injection of the glucose acts both to prevent and counteract any degree of acidosis which may be present, and is further a stimulant. It also represents an easily assimilable food. For a detailed description of the method of preparation of this agent I would refer the reader to the article by Lowsley.

Lowsley has found that in bad operative risks, the administration of the gum-glucose solution throughout the operation and during the ensuing hour, gives an added advantage to the patient. The Buckstein apparatus is regularly employed. The solution must be introduced very slowly, frequently one to two hours being consumed in the injection of 300 c.c. solution.

5. *Operation.* If a surgical procedure is necessary, do we thoroughly appreciate the fact, so many times emphasized by Crile, and so well, that the surgeon himself may be a serious traumatizing agent in the progress of the operation? Is the effort constantly made to reduce to a minimum the element of trauma during the operation? Save in the presence of considerable hemorrhage, all observers agree that an effort should be made to bring the shocked patient as nearly as possible to a normal state, before submitting him to the hazard of operation. After obtaining a reasonable reaction by some of the simpler means, or by gum-glucose solution, or even by transfusion, the surgeon should determine upon the shortest possible operation under an anesthetic, preferably nitrous oxid-and-oxygen rather than ether, and by a technic with the minimum of trauma. A prolonged operation under ether upon a patient badly shocked will almost invariably result fatally.

The preservation of bodily heat during the progress of the operation may be accomplished by the use of the inflated cushion devised by Crile. This cushion may be filled with water of any temperature. It affords a soft, yielding surface for the shocked patient to lie upon. If such a cushion is water bags about the patient may add to the maintenance of bodily heat. In the service abroad shocked men were not infrequently placed, immediately upon their reception at the hospital, upon a warmed operation table, the source of heat being electric lights lying beneath the operating slab. Upon this table all preparations for the operation were carried out, and upon it the operation itself was performed.

During the operation in a case of traumatic shock, especially where there has been some loss of blood, additional bleeding, even of a small amount, may serve to turn the balance unfavorably and cause the patient to succumb.

The diminished power of the blood to carry oxygen causes diminished alkali reserve and a state of acidosis, the degree of which may vary considerably. Moreover, we are familiar with the fact that the more prolonged the operation and the more ether inhaled, the greater the degree of acidosis following a surgical procedure. In the acidosis attendant upon shock, as well as that complicating operation, the ordinary measures, so well recognized today, of rectal instillations of a 5 per cent. solution of sodium bicarbonate, with or without a 7 per cent. solution of glucose, assist in restoring to the blood its normal alkali reserve.

In conclusion. I believe that a more thoughtful consideration of the experiences abroad in the whole shock field and a more careful appreciation of the similarity of our traumatic cases in civil life with those in the

war zone will lead to an adoption by us of simple, practical measures against the advent of shock after trauma, and the practice of more effective means of combating it.

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TREATMENT OF RECURRENT INOPERABLE CARCINOMA OF BREAST BY RADIUM AND ROENTGEN RAY*

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All cases of carcinoma of the breast may be classified in one of five clinical groups, (1) primary operable; (2) primary inoperable; (3) recurrent operable; (4) recurrent inoperable, and the (5) prophylactic group, the last comprising patients referred to us following radical operation of the breast for prophylactic irradiation, there being no obvious evidence of cancerous disease at the time of their admission.

The present paper is a study of recurrent mammary cancer treated in the breast clinic at the Memorial Hospital during the years 1918, 1919 and 1920, comprising a series of 218 patients, practically all of whom have been completely followed up to the present date.

We have included none from the 1921 group, as sufficient time has not elapsed to warrant reporting the results of treatment. The object of this paper is to determine whether or not radiologic treatment of recurrent carcinoma of the breast is justified by the results obtained in this clinic.

Most of the recurrent cases were inoperable at the time of their admission to the clinic. In the recurrent breast group, only six patients have presented themselves, in the years 1918, 1919 and 1920, who could fairly be classified as having operable cases. A small, nonadherent skin lesion, or a small movable node, low down in the axilla, may properly be considered operable, if no other evidence of disease is to be found. Under these circumstances it is a correct procedure to excise the recurrent nodule, irradiation being given both before and after operation. With the presence of several such lesions, however, one must conclude that the disease is probably widely disseminated, and any

* Read before the Section on Surgery, General and Abdominal, at the Seventy-Third Annual Session of the American Medical Association, St. Louis, May, 1922.

thought of any operative relief must be discarded. In this event, irradiation is the type of therapy that must be relied on.

A considerable number of cases, namely, ninety-four, were so far advanced at the time of admission that they were obviously hopeless from the outset. The very advanced breast recurrences must be set apart from those cases in which a reasonable palliation, if not a considerable regression of the disease, may be expected. All that one may hope to accomplish for those patients with a far-advanced lesion is a relief of their suffering by adequate amounts of codein or morphin; frequent

Fig. 1.—Recurrence of inflammatory carcinoma; this type of case always extends rapidly.

dressings when foul ulcers are present, and perhaps at times sufficient to satisfy the mind of the patient that treatment is still in progress. If we therefore exclude these patients from the whole number of 218 cases, we have remaining 124 patients in whom irradiation as a therapeutic agent could be entertained with a fair hope of some favorable result.

THE PREVENTION OF RECURRENCE

Proper Selection of Cases.—In the recent rapid development of therapy by roentgen ray and radium the surgeon has at times seemed unwilling to relinquish

anything in the surgical treatment of cancerous disease. The presence of a carcinoma in a breast is not necessarily an indication for a radical amputation, for a careful physical examination of the patient may reveal some factors which would militate against success by operation. The cases treated surgically must therefore be well chosen if the percentage of recurrence is to be kept at a minimum.

Preoperative Irradiation.—It has been the practice at the Memorial Hospital for several years to give a preoperative cycle of roentgen ray in every case of carcinoma of the breast before submitting the patient

Fig. 2.—Diffuse cutaneous metastases before irradiation.

to operation. As a rule, a period of from seven to ten days is allowed to elapse, between the time of the last irradiation and the day of operation. We believe that the preoperative cycle is of great service in forestalling recurrence, but up to the present time a sufficient number of cases has not been accumulated to furnish a proper comparison with groups of patients in other clinics where the preoperative use of the roentgen ray has been omitted; eventually such a study will unquestionably furnish a proper estimate of the real value of preoperative treatment. In the vast majority of cases we have seen no evidence which would lead us to

believe that the preoperative cycle interferes materially with wound healing, or adds to the liability of wound infection.

Postoperative Irradiation.—From two to three weeks following operation, every patient is subjected to a postoperative series of roentgen-ray treatments over the whole breast and drainage areas. An interval of from six weeks to two months is then allowed to elapse, when a second similar cycle is administered. Sufficient data have already been accumulated at the hospital to make one feel very certain that postoperative treatment prevents certain recurrences and postpones the appear-

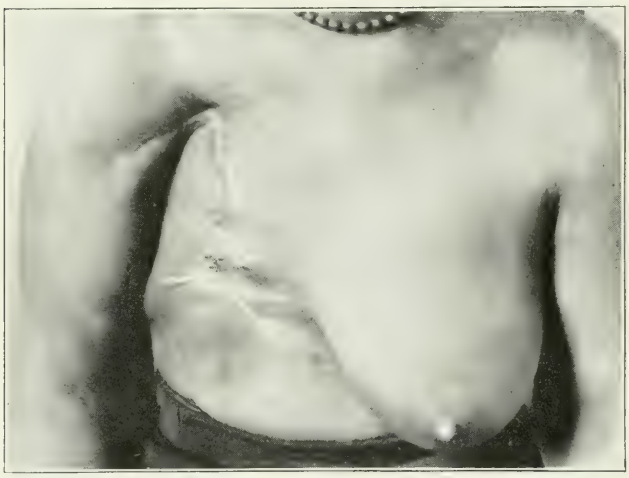

Fig. 3.—Disappearance of cutaneous metastases following irradiation (same case as in Fig. 2).

ance of practically all recurrences. In addition, it unquestionably prolongs the life of the patient. We feel, therefore, that postoperative irradiation has proved its worth without any reservation.

RESULTS OF TREATMENT

One may well ask what the average expectation of life is from the time of the first appearance of a recurrent breast tumor without any irradiation. Such a question might imply that all breast cancers are of the same pathologic type and follow a similar clinical course. We know that this is not the case. At present,

with the cooperation of Dr. James Ewing, pathologist at the Memorial Hospital, we are engaged in an effort to classify more satisfactorily the various types of carcinoma from a pathologic point of view and to study their reaction to various forms of irradiation. A papillary adenocarcinoma, a tumor well known to be of low-grade malignancy, will certainly permit a longer period of life following recurrence than a rapidly growing cellular tumor. Similarly, a fibrocarcinoma in

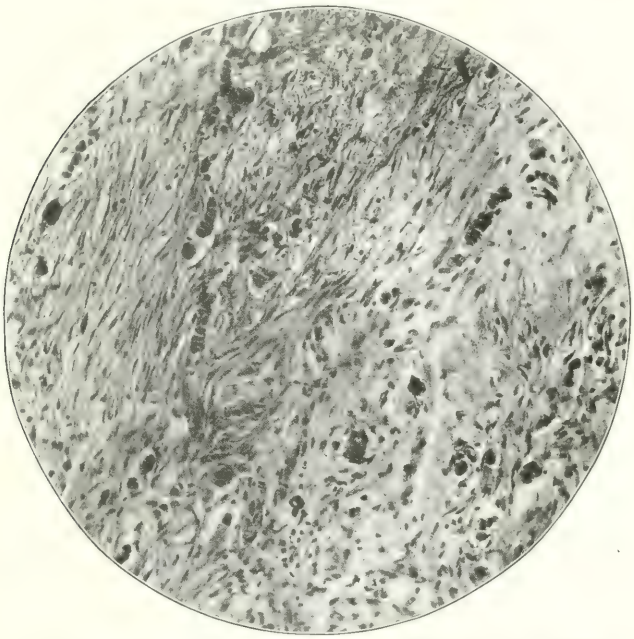

Fig. 4. Granular degeneration of cell bodies; hyperchromatism of nuclei, and granular degeneration of the stroma.

a woman of 70 may be expected to grow with much less rapidity following reappearance of the disease than a fulminating recurrence complicating pregnancy in a young woman. Nevertheless a gross clinical judgment as to the value of irradiation as a means of treatment for recurrence may be reached if we compare results giving the duration of life from the appearance of recurrence in nonirradiated and irradiated patients.

At the New York Hospital, in the First Surgical Division, where, through the courtesy of Dr. Charles L.

Gibson, I was able to follow the breast cases especially, the length of life after recurrence in a series of twenty-two patients on whom a radical amputation had been performed, with no subsequent irradiation, was six and a half months. In the patients in the present series, who have been treated by irradiation following the appearance of recurrence, the length of life after recurrence has been two years and four months, a decided advantage, as one may readily see, in favor of irradiation.

RESULTS IN THIRTY-ONE CASES

Case	Operation to Recurrence		Recurrence to Date		Total Duration After Operation	
	Years	Months	Years	Months	Years	Months
Patients Doing Well						
1	.	6	3	8	4	2
2	13	..	6	..	19	..
3	.	7	4	10	5	5
4	..	3	6	4	6	7
5	..	3	4	8	4	11
6	.	2	3	..	5	..
7	2	3	3	5	5	8
8	..	1	2	9	2	10
9	..	.	3	2	3	2
10	2	..	2	10	4	10
11	..	3	1	8	1	11
12	..	..	2	..	2	..
13	.	1	2	2	2	3
14	1	..	1	6	2	6
15	..	9	1	7	2	4
16	7	1	2	4	9	5
17	2	..	1	8	1	10
18	1	1	2	2	3	3
19	1	7	1	11	3	8
20	8	..	1	10	2	6
21	6	4	2	2	8	6
22	10	..	1	10	2	4
Patients Doing Badly						
23	.	3	5	..	5	3
24	1	1	3	..	4	6
25	1	.	3	8	4	8
26	..	..	2	10	2	10
27	..	11	4	9	5	8
28	1	6	3	6	5	..
29	..	6	2	3	2	9
30	4	..	2	7	6	7
31	3	..	2	3	5	3

Of the total of the 124 patients in whom some favorable results from irradiation might be expected, thirty-one are alive at the writing of this report, which is 25 per cent. of the total number. Of the thirty-one patients, twenty-two are doing well, while nine are doing badly. A brief table is given, that the data may be more readily available.

In general, the more cellular the tumor, the better the response to treatment by irradiation. The younger the woman and the more rapid the recurrence, the poorer is the result to be expected from irradiation.

TYPES BEST SUITED FOR IRRADIATION BY RADIUM

Small localized lesions in the infraclavicular region, or adherent to or involving the chest wall, small localized skin metastases or small accessible nodes are most amenable to treatment by radium itself.

Some of our best results following the use of radium in the recurrent group have been in the infraclavicular region. In some of these cases, applications of a radium pack have resulted in a complete disappearance of the growth. One of the patients has now gone one and a half years with no further evidence of disease to be made out. The details of radium therapy and the methods employed have been fully described in a recent article,[1] and will not be described here.

TYPES BEST TREATED BY THE ROENTGEN RAY

Recurrences best treated by the roentgen ray include diffuse cutaneous involvement, examples of so-called inflammatory carcinoma, extensive involvement of nodes in the axillary or supraclavicular regions, and mediastinal or pleural metastases, as well as bony metastases, in various parts of the body. The technic employed has been fully described in a recent paper. At present we are still depending mainly on the old type of roentgen-ray machine, and have been reasonably satisfied with the results obtained. Some of the most striking effects have been seen in the treatment of diffuse cutaneous involvement, an area of considerable disease disappearing in a few weeks under appropriate irradiation, leaving an apparently normal skin. In some of these cases a later follow-up has shown a reappearance of the lesion.

The new 200,000 volt machine now in operation is being used on carefully chosen patients, but sufficient time has not elapsed to make any report on this method of therapy. We are very hopeful that some of the mediastinal and pleural extensions of the disease may yield some encouraging results by this new method of treatment.

The gross and microscopic effects of the treatment of cancerous diseases by radium and the roentgen ray will not be enumerated here, as they have been described elsewhere.

1 Lee, B. J.: Results to Date in the Treatment of Primary Inoperable Carcinoma of the Breast by Radiation. Ann. Surg., September, 1922.

CONCLUSIONS

1. As a prophylaxis against the recurrence of breast carcinoma, a careful selection of patients for operation must be made.

2. Preoperative and postoperative cycles of roentgen ray are important prophylactic measures against recurrence.

3. A follow-up in every patient with carcinoma of the breast operated on should be adopted as a routine. No surgeon should operate on a patient with breast cancer without appreciating that an integral part of the procedure is following up the patient, with the idea in view of discovering the appearance of metastases at an early date, permitting the application of irradiation as soon as possible.

4. Properly applied irradiation to recurrent breast carcinoma definitely prolongs the life of the patient.

5. I believe that ultimately, with more complete knowledge and better technic, a still further control of the recurrent phase of this disease may be expected.

128 East Seventy-Third Street.

Reprinted from the Journal of the American Medical Association
Nov. 4, 1922, Vol. 79, pp. 1574-1576

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RESULTS AND TECHNIQUE IN THE TREATMENT OF CARCINOMA OF THE BREAST BY RADIATION*

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AS a part of the organized effort at the Memorial Hospital, which has been carried on for several years, to study and treat malignant disease in its many varied phases, a breast service was organized in 1919, to concentrate under a single head the work in this field. It has been my privilege to be responsible for this service, and the present paper presents a brief summary of the technique employed and the results accomplished up to the present time.

The cases under report were admitted to the hospital in the years 1918, 1919 and 1920, and none of our cases of the last year and a half have been included. We believe that too often radiation is thrown into disrepute as a therapeutic agent by over-enthusiastic reports of brilliant recent results. Certainly, any form of treatment applied to cancerous disease must stand the test of considerable time to determine its real value, and radiation is no exception to this rule. Further, a record of the exact status of the case at the time of admission, with continuous notes of observation and treatment, are useful, if one is to estimate what really has been accomplished.

TECHNIQUE

X-Ray Treatment. There has been an evolution in the *x*-ray treatment of breast cases during the past few years at the Memorial Hospital. Recently, and up to the present time, all treatments have been given by the ordinary type of *x*-ray machine, delivering a peak voltage of approximately 90,000. Some years ago, the exposures were three to four minutes each, with a spark gap of 8 in., and a focal distance of 8 or 9 in., using 4 ma. current and 4 mm. of aluminum filtration. These exposures were given at varying intervals, usually four or five weeks apart. Eventually, definite telangiectases appeared in the radiated skin, and, in one or two instances, definite epitheliomata developed in the site of the overradiated area.

Three or four years ago, the time period was lengthened to six or seven minutes with a spark gap of 10 in. and a 10-in. focal distance, with intervals between the treatments of about five or six weeks, the number of treatments given over any one area usually not being more than three or four. This type of radiation has undoubtedly a more penetrating effect and the skin becomes definitely pigmented, but up to the present time only a few cases have shown marked telangiectasis.

Within the last year, stimulated probably by the recent work with the high-voltage machines, the time period has been increased from fifteen to eighteen minutes and longer, with a 10-in. spark gap and a 12- to 15-in. focus skin distance, using 4 ma. of current and 4 or 5 mm. of aluminum filtration. This technique has been used where the tumor of the breast was of considerable thickness and a definite radiation of the deeper tissues was desired. Where superficial, subcutaneous nodules were being cared for, the older type of radiation with five- or seven-minute exposures has been the usual procedure.

We have used the *x*-ray routinely for pre-operative treatment before a radical operation, giving one complete cycle of about four treatments over the whole breast and axillary and supraclavicular regions. Following operation, after the wound has completely healed, usually in two or three weeks, it has been our practice to give two complete *x*-ray cycles covering the whole breast and lymphatic drainage areas. We feel certain that unless a very definite and pronounced erythema of the skin is produced following *x*-radiation, a tumor lying in the deeper portion of the breast has not been sufficiently radiated.

Treatment by Radium. Treatment of breast carcinomata by radium has been applied by one of five separate methods of application or various combinations of them, namely: pack, tray, dental mould, insertion of bare emanation tubes, and the

* Read at the Seventh Annual Meeting of THE AMERICAN RADIUM SOCIETY, St. Louis, Mo., May 22–23, 1922.

Reprinted from the January, 1923, issue of THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, Vol. X, No. 1, pages 62–66. Copyright, 1923.

insertion of platinum needles containing radium emanation.

The pack has been frequently described by various members of the Memorial Hospital Staff, and I need not go into many details concerning its construction. Suffice it to say it provides a filtration of ½ mm. of silver and 2 mm. of brass, and for ordinary breast tumors and axillary nodes it is placed at a distance of 6 cm., maintained by a wooden block beneath the pack, giving a dosage of 8,000 to 9,000 mc. hours over an area of approximately 70 sq. cm. This is particularly of use, we believe, in breast carcinomata involving the chest wall and sternum, small tumors of the breast itself, and over the axillary and supraclavicular regions, particularly if the nodes are deeply placed. We make use of it also in metastases over bones with a similar dosage, and in spinal metastases at a distance of 10 cm., we give approximately 16,000 to 18,000 mc. hours of treatment, with considerable relief of pain in some instances.

The tray is a smaller external applicator giving the same filtration, but used at a distance of 3 cm. for more superficial and localized nodules, the dosage reaching 2,500 to 3,000 mc. hours. We have found, as our work has developed, that we are using the tray less and less, as the larger drainage areas, such as the axillary and supraclavicular regions, often contain deeply placed nodes which are more efficiently radiated by the pack than the tray.

The dental mould, carrying silver filtrated radium, we have used in a number of cases of Paget's disease of the nipple with a very limited lesion present, and, in one or two instances, in small inoperable carcinomata placed exactly at the junction of the chest wall with the breast, the mould fitting nicely over the carcinomatous mass. Radiation by this method has recently given some very satisfactory results.

The insertion of emanation bare tubes by means of a long needle carrying a plunger is being used very extensively in primary inoperable tumors, giving a dosage of approximately 1 mc. per c.c. of tumor tissue. Caution should be exercised that the bare tube is not placed nearer to the skin than 1 cm.; otherwise it may cause an area of ulceration. Also, one should be careful to avoid placing the bare tube directly against a rib or rib cartilage, because of the possibility of injuring the periosteum. The general tendency in earlier years was to give repeated treatment by bare tubes in small doses. The present technique consists in carefully estimating the exact size of the tumor at the time of the original visit of the patient; and an effort is made at the time of the primary treatment to accomplish a complete radiation of the tumor, always, however, after an *x*-ray cycle has been given. In some cases now under observation, we believe no second introduction of bare tubes will be necessary in the breast tumor itself.

Localized subcutaneous nodules in the chest wall may also be cared for by the implantation of small bare tubes of 1 mc. strength beneath the nodule, but they may be equally well or even better treated by *x*-radiation. The introduction of bare tubes into axillary nodes has turned out to be a difficult matter, for without opening the axilla, one cannot accurately localize the nodes at the time of introduction, and so a satisfactory implantation may be impossible. We frequently find, on opening the axilla in the endeavor to isolate nodes, that it is easier to dissect out fat and nodes themselves than to attempt to introduce radium into the separate nodes. More recently, we are placing bare tubes along the inferior posterior aspect of the pectoral muscle, believing that a reasonably efficient radiation of the axilla may be accomplished by this means. Bare tubes should never be placed nearer than 1 cm. to the branches of the brachial plexus, as an intractable case of neuritis may ensue. In general, we have found the management of axillary nodes one of the big problems in the treatment of breast carcinomata by radiation, and we feel that our present means of attack is not wholly satisfactory.

Within the last eight months we have been using the platinum needle, giving a filtration of $\frac{4}{10}$ mm. of platinum, carrying radium emanation tubes of about 60 to 70 mc., giving a dosage of 50 mc. hours per c.c. The theoretical difference

between this needle and bare tubes is that no foreign body is left in the tumor and a less accurate implantation is required. We have had some recent interesting regressions in tumors treated with this method, but have not sufficient data at present to make a satisfactory report upon the results obtained.

Pleural and mediastinal involvements have so far not been completely radiated, for the necessity of radiating normal tissue and the length of time required have made it difficult to accomplish. We are hoping that a treatment of the chest areas with our new high-voltage machine may give more satisfactory results in the pleural and mediastinal areas.

RESULTS IN VARIOUS GROUPS

Primary Operable Carcinoma of the Breast. Following radiation of a breast carcinoma, a definite fibrosis occurs in and about the tumor, but the mass present may not contain any definite living tumor cells. In a case which has shown considerable regression, if radiation is persisted in, and especially if bare-tube insertion or the platinum needle is employed several times, one is very apt to break down connective tissue in and about the tumor, causing an intractable ulceration. It is much wiser to avoid overradiation of such cases, being satisfied with a fair rather than a perfect result.

The average routine case in this group is given a pre-operative *x*-ray cycle, followed three to four days afterwards by a complete radical operation, using the Willy-Meyer-Halstead technique, both muscles being removed. A very long oblique incision is made, running 2 in. below the costal margin, and this usually enables complete closure of the wound. Very careful and wide dissection of fat and fascia underlying skin flaps is made. We have had but very few instances of skin recurrence in the clinic in the past three years, so that we feel that this type of operation without a wide sacrifice of skin, is justifiable. When the wound is completely healed, two or three weeks following operation, a complete postoperative cycle of *x*-rays is given. The case is followed routinely in the breast clinic indefinitely, month by month, and treatment is given as indicated.

Exceptional cases occurring in the primary operable group are the women at or above seventy years of age, which special group we have determined to follow through, entirely on the basis of treatment by radiation. Although some older women are perfectly good operative risks, we feel that this is a justifiable procedure in these cases, and we are following this limited group with a considerable degree of interest. Further, we believe that a definite obligation rests upon Memorial Hospital to develop data of this sort, and we believe that it is possible without added risk to our patients. We have had some very interesting and satisfactory results to date, covering a period, in some cases, of two years. The procedure for such cases is *x*-ray externally, and insertion of bare tubes into the tumor and axillary masses. We do not, however, feel justified in making a further report at present on these cases.

Primary Inoperable Carcinoma of the Breast. This constitutes one of our large groups, and certainly one in which, without radiation, a practically hopeless result must be expected by the surgeon in charge of the case. Of the 83 cases occurring in this group in the period covered in the present report, 26 were very advanced, the average duration of life after treatment approximating four months, with a total average duration of two years and 9.2 months. All the cases in this group are dead. Of the 57 more favorable ones which might reasonably be treated with some hope of success, 25 are alive at the writing of this report of those doing well. Of these, 12 are doing badly, and 13 are doing well. The average duration of life after treatment was two years and 3.1 months, the longest duration after treatment being four years and the shortest, one year and 5 months.

Recurrent Inoperable Carcinoma of the Breast. This is our largest group in which the surgeon must look to the radiologist for definite help, for treatment by radiation offers practically the only hope of checking the disease or curing the patient. In the years 1918, 1919 and 1920, only six patients presented themselves to the

hospital whom we felt justified in classifying as recurrent operable carcinomata of the breast.

In the treatment of these cases, *x*-radiation has been by far the agent most often employed, and, the radium pack or radium bare tubes have been used in well localized, sharply defined recurrent masses. In comparing our series of recurrent cases, covering three years, with those of another New York Hospital where no radiation was used after operation or for recurrence, we find that our period of life following recurrence is three times as long as theirs. We feel, therefore, that the treatment of recurrent cases by radiation gives, without doubt, a marked prolongation of life. In our group of recurrent inoperable cases, we have felt it wise to make a subdivision between the really advanced cases and those in which reasonable hope of improvement might be expected from radiation. Excluding the very advanced cases, we have had 124 in the recurrent inoperable class, 31 of which are alive, some of them doing well. We therefore are greatly encouraged in the treatment of these cases by radiation.

Prophylactic Cases Reported for Treatment after Radical Removal of the Breast for Carcinoma. We have routinely given a pre-operative *x*-ray cycle for the past four or five years. We believe that it is of definite service, and that it does not materially interfere with wound healing. Sufficient evidence has not accumulated up to date to determine whether or not the pre-operative cycle prevents or delays a possible recurrence, but we believe that it may do both. A later study, comparing a large group of cases in which a pre-operative cycle was not used with one at Memorial Hospital in which it was, may furnish some data to settle the question of usefulness.

Concerning the postoperative cycle, we feel certain that it is efficient and that it has given marked results in cases where it has been employed, for we know it lengthens the time between the operation and recurrence. We believe, too, that it may entirely prevent a recurrence, if properly planned and administered, and delay the rate of growth when recurrence has already occurred.

Pathology. As to the pathology of cases under our care, we have made an earnest effort to obtain microscopic sections of as many cases as possible in the clinic, but at present we have been able to obtain this information in only about 40 per cent of the cases. Up to the present it has been difficult to correlate the histological picture with the clinical behavior of the disease, although certain anatomical types follow a more or less fixed clinical course, but we hope that by observation and study we may reach a more reasonable basis for therapy for the various anatomical varieties of breast carcinoma.

CONCLUSIONS

All in all, the outlook in the treatment of carcinomata of the breast by radiation is a most encouraging one. We feel that in no case of mammary cancer treated by surgery can the proper use of *x*-radiation be discarded. Radiation, properly administered, is the most effective aid in the care of carcinoma of the breast surgically treated; and in every surgical clinic a pre-operative and postoperative cycle should be employed if best results are to be obtained.

As to the treatment of primary inoperable and recurrent cases: We feel that our best method at present is external radiation by *x*-ray, with a fifteen-minute exposure, 10-in. spark gap, and 12-in. focal distance, with 4 mm. aluminum filtration, and 4 ma. of current, followed by an implantation of radium bare tubes into the growth, giving a complete dose at the first sitting. We are greatly encouraged at the present outlook.

We know that surgery has something very definite to offer for the relief of carcinoma of the breast, but we also feel that a more careful follow-up of cases in the surgical field may reveal a much poorer percentage of five-year cures than is generally believed. Our own conviction is, that of 100 cases treated surgically, 15 to 25 per cent may be expected to be alive at the end of five years.

With such a discouraging outlook afforded by surgery, we feel that the addition of radiation to the treatment of this terrible disease should be followed in a most careful and systematic manner, the radiologist and the surgeon working together to solve the therapy of the disease.

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REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
NOVEMBER, 1920.

PERFORATING GASTRIC AND DUODENAL ULCER*

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OF THE acute abdominal crises perforation of a gastric or duodenal ulcer ranks easily first in its dramatic suddenness of onset, its violence of symptomatology, and its gravity.

During the past six years I have operated upon twenty-four of these acute perforations with three deaths, a mortality of 12½ per cent. Contrary to the usual statistics, a large majority of my cases have been gastric rather than duodenal, but with one exception, all were within 3 inches of the pyloric ring.

The duration of acute symptoms has been within the twenty-four-hour period in all but two cases, both of which died, and many cases were within twelve hours. The peritonitis was localized to the site of perforation in all except the two fatal cases mentioned. The ulcer base varied in size from 2 to 8 cm. and the perforation from 3 to 8 mm. Closure was easily effected in all save two, to be described later in this article. Infolding mattress sutures of fine chromic gut, in two layers, widely placed, were used exclusively. Posterior gastro-enterostomy was done but once, the details of which will be given later.

No "toilet" of the peritoneum was carried out and no drainage used for the uncomplicated cases. The appendix was found markedly involved in all cases and removed except in the three fatal cases and one other very poor risk. One case had a coincident acute cholecystitis and appendicitis. The appendix was removed and the gall-bladder drained. Two cases with coincident cholecystitis and cholelithiasis were treated by partial cholecystectomy and drainage.

Recovery in all but the fatal cases was remarkably smooth and uncomplicated except for a few mild superficial infections.

The end-results in the twenty-one recovered cases are known in about one-half the cases. Two came to gastro-enterostomy for pyloric stenosis. Of these one had had a previous perforation sutured in another clinic. Both were completely relieved. All the remaining cases seemed entirely free from ulcer symptoms and were in excellent general health when last examined.

The diagnosis in all the uncomplicated cases was obvious on the most cursory examination. The exceptions are as follows:

CASE I.—A man, aged about forty years, with a history of lues and

* Read before the Clinical Society of Montclair, June 7, 1920.

definite signs of tabes. He had had repeated gastric crises. For about twenty hours he had had severe epigastric pain. Tenderness and rigidity were moderate. There was a slight rise in temperature and in the leucocytes. Operation revealed a small ulcer near the pylorus with perforation a few mm. in diameter. Recovery was uneventful.

Case II.—Colored female. She was in very poor general health, had signs of tuberculosis of the lungs and rather marked hyperthyroidism. An ulcer of the lesser curvature had been discovered by X-ray and was being treated medically, but she became unmanageable and left the hospital. In a few hours she returned with severe pains and signs of perforation. She was quite hysterical and persisted in sitting upright. Nothing could persuade her to lie down. Operation disclosed an ulcer on the posterior surface of the stomach near the lesser curvature and an acute cholecystitis with cholelithiasis. The ulcer was œdematous and bled freely, but had not completely perforated. It was infolded with great difficulty, the gall-bladder removed nearly entirely, and drainage inserted. Recovery was quite stormy and protracted.

Case III.—Male, white, aged about forty years. Attack began six hours previously and was typical in all symptoms except that as in Case II the patient persisted in sitting upright and could not be induced to lie down for more than a few seconds. Operation revealed a perforated ulcer near the pylorus and an acute cholecystitis. The gall-bladder was removed, drains were inserted, and recovery was uneventful.

Case IV.—Male, white, aged about forty years. The history and signs in this case were typical except that the temperature and tenderness were excessive and the leucocytes were high. Operation revealed an acute cholecystitis and cholelithiasis with perforation into the duodenum. Possibly this case should not be included in an ulcer series, but an acute perforation of the duodenum certainly had occurred. A partial cholecystectomy was performed, drainage instituted, and no attempt made to close the perforation. Recovery was delayed and rather troublesome, but finally was complete.

Case V.—Male, white, aged forty-five years. Had definite ulcer symptoms and had been given a positive diagnosis of duodenal ulcer five years before the acute onset. He was a Christian Scientist, however, and refused treatment. At the end of this time a severe hemorrhage brought him to terms and he began medical treatment. During a month he gained 8 pounds and seemed on the way to recovery when he had a sudden onset of violent pain with slight rise in temperature, pulse, and leucocytes. At operation a very large ulcer involving the pylorus, duodenum, and stomach was found, with perforation into the pancreas from the duodenal side. No safe operative approach was possible and a posterior gastro-enterostomy was done to relieve the stenosis. A drain was inserted. He made a fair rally for twelve hours, but succumbed at the end of thirty-six hours from asthenia. Post-mortem examination showed no extension of the peritonitis and no especial reason for the fatal outcome.

In another similar case I would be tempted to do a simple jejunostomy rather than a gastro-enterostomy. I did not realize his weakened general condition. Of the two other fatal cases, one was in a very stout alcoholic with advanced cirrhosis of the liver and a perforation of several days' standing, with generalized peritonitis. The ulcer was very large and appeared possibly malignant. Death occurred about twenty-four hours after operation. No post-mortem was permitted. The third fatal case was in a feeble subject also, with cirrhosis of the liver. Perforation had occurred two days previously and there was a marked spreading peritonitis. No drainage was used. The wound was opened the following day and drains inserted, but death occurred from exhaustion on the following day. All the cases showed a free perforation except three, two of which have been previously described. The third showed a perforation covered by the liver and partially sealed.

The diagnosis of acute perforation of the stomach or duodenum is remarkably easy except in the complicated cases. On the other hand, acute perforations of the gall-bladder from gangrene, acute pancreatitis, and occasionally high-lying perforated appendices will give symptoms suggestive of stomach perforation. In no case that I have seen, however, has there been any such onset of agonizing pain, nor such board-like rigidity in the first few hours. After twenty-four hours, of course, the symptoms are masked by the spreading peritonitis.

Shock has never appeared to me to be present in any of the cases. Vomiting is not the rule, either.

One case of error in diagnosis caused me great chagrin. A soldier was suddenly taken violently ill at midnight with intense epigastric pain. Examination showed extreme rigidity of the abdomen, and the previous history of loss of weight and vomiting of blood with "dyspepsia" seemed to clinch the diagnosis. The ward surgeon was summoned and, much to my disgust, was able to demonstrate the symptoms were all assumed and that the real diagnosis was a very mild attack of "flu." To the best of my recollection this is the only non-surgical case I have seen at all simulating an acute perforation.

That perforations do occur which become quickly adherent and closed is undoubtedly true. I have seen a few that might possibly have been such, besides one that had gone on to a local abscess formation. Many times adherent scars suggestive of old healed perforations are found at operation or post-mortem. The great majority of acute perforations, however, go on to spreading peritonitis and death if not closed surgically.

The treatment of acute perforations is obvious and, moreover, is easily carried out in nearly all cases. A simple high laparotomy and suture of the opening can be done in a very few minutes. The only question of other procedure is whether a gastro-enterostomy should be added. Deaver urges that this be done in all cases. Conners is just as strongly opposed. Many surgeons, like Peck, take a middle ground, doing the gastro-enterostomy in cases seen early and without peritonitis.

The argument for gastro-enterostomy, of course, is that it tends to aid in the healing of the ulcer and to obviate a later operation for resulting stenosis. On the other hand, it is well known that by far the greater number of all perforating ulcers tend to heal promptly after closure and that reperforation, hemorrhage, and stenosis are exceptional sequelæ. Moreover, it is difficult, if not impossible, to tell at the time of operation whether or not stenosis will occur. The mere fact that it is present after the suturing has been done is not conclusive, as it is very improbable that such stenosis will persist. When one considers how difficult, if not impossible, surgeons have found the operation of pyloric occlusion, surely it can hardly be thought a few fine chromic sutures will bring about this end.

To my mind, however, the strongest arguments against the added operation are twofold. First, the added immediate mortality will be considerable. Even in the hands of such masters of surgical technic as Peck, Deaver, and the Mayos, there is a certain, although low, mortality for gastro-enterostomy, even in non-acute cases. Second, the end-results of gastro-enterostomy, even in the best clinics, are not 100 per cent. good. When one considers that by far the great majority of these acute perforations will always be operated upon by surgeons of much less skill and experience, especially in gastric surgery, it would seem only the part of wisdom to do the simple life-saving operation and await the result, with a later gastro-enterostomy for the small percentage of those requiring it. I feel sure that I voice the feelings of most conservative medical men, including surgeons, in saying that I would not care to have a gastro-enterostomy done on myself if it could be avoided.

The cause of gastric ulcer is yet unknown, but the occurrence of chronic appendicitis in such a large proportion of the cases is suggestive of one etiological factor. Other chronic infections probably have a similar relationship.

In my cases it was usually difficult or impossible to obtain any history of chronic gastric disturbance before operation, but afterward when the severe mental and physical distress were abated, close questioning usually elicited a fairly typical ulcer history.

In conclusion, twenty-four cases of acute perforation resulted in eventual cure in twenty-one patients. One of the fatal cases was hopeless at the time of operation and the other two were in very grave condition.

Early diagnosis and simple closure of the perforation will result in cure in a very large proportion of cases. Gastro-enterostomy should be reserved for the few who may need it later.

I wish to express my most sincere thanks to Doctors Charles L. Gibson, Alfred Taylor, and William Luckett, in whose service these cases, with two exceptions, occurred, and to whom I am deeply indebted for the privilege of publishing them.

NOTE.—Since this paper was read one more case has been operated upon by me in the service of Professor Gibson, the Cornell Division of the New York Hospital. Recovery ensued after a very stormy convalescence.

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
JANUARY, 1921.

PICRIC ACID IN OPERATIVE SURGERY*

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(From the Laboratory of Surgical Pathology of Cornell University Medical School.)

PICRIC acid, $C_6H_2(NO_2)(_3OH)$, a substitution product of phenol, has been used for many years in the treatment of extensive superficial burns, a 1 per cent. watery solution being employed. It has also been used largely by me during the past ten years in the treatment of minor cuts, extensive abrasions, severe contusions, and for minor operative surgery. Its advantages over iodine were its cheapness, its stability, its mild anæsthetic properties, and especially its lack of toxicity and irritation. Its one disadvantage was its tenacious and loud coloring of everything it touched.

During the war picric acid in 5 per cent. solution in 95 per cent. alcohol became very popular in the British Medical Service and proved quite efficacious. It was adopted, at Professor Gibson's suggestion, by the First Surgical, or Cornell, Division of the New York Hospital and has been in use now about two years. It has met with approval by all the members of the attending staff and will continue to be used until something better is offered.

A number of problems at once present themselves in relation to the use of any skin antiseptic, such as absence of irritating qualities, penetration, rapid bactericidal action, etc. The bactericidal properties of picric acid have been worked out by Doctor Wheeler of the bacteriological department and are appended.

Picric acid in 5 per cent. alcoholic solution can be applied with impunity to any part of the body except possibly the conjunctiva. I have never seen, after ten years' use, any signs of irritation from the picric acid itself, even when repeated many times at frequent intervals. Care must be taken, however, not to tan the skin too much, or blebs may form in the deeper layers and eventually mild infections ensue. This is especially true about wounds already infected, as a marked scab formation results and pus retention may occur beneath the scab.

Portions of the body subject to marked intertrigo must be watched after the use of picric acid with occlusive or irritant dressings, but less so than after the use of iodine.

Irritant chemicals such as bichloride of mercury, iodine, etc., must be used with reasonable care in conjunction with picric acid. Finally, dressings saturated with picric acid become exceedingly inflammable when dried.

* Read before the Surgical Section of the New York Academy of Medicine, March 5, 1920.

With the aid of Doctor Spencer and Doctor Kingery, of the New York Hospital, a number of experiments on guinea-pigs were carried out to determine the effect of picric acid on the peritoneum. Four healthy pigs received intraperitoneally hypodermic doses of picric acid in watery solution ranging from 2 c.c. to 1 c.c. 1 per cent. solution, and .05 to 1 c.c. of 5 per cent. solution. No ill effects whatever were observed, except that the pigs seemed slightly shocked by the peritoneal irritation.

Laparotomies were performed under anæsthesia upon these same four pigs at the expiration of six weeks. No adhesions were found and all organs appeared perfectly normal. The only preparation for these laparotomies was an application of 5 per cent. alcoholic picric acid solution to the skin, without shaving. The operator's hands were not washed, but were dipped in the picric solution. The intestines were allowed to protrude freely onto the abdominal wall and were subjected to quite rough handling with dry gauze.

The wounds were sutured and all four pigs made an excellent recovery. One died at the end of six weeks from abortion. All were subjected to post-mortem examination by Doctor Spencer and nothing abnormal was found. The conclusion seems justified that in guinea-pigs, at least, picric acid in rather large amounts does not tend to cause peritoneal adhesions. In this connection, I might also state that I have occasionally used picric acid on the stump of the appendix with no apparent ill effects.

Picric acid in alcoholic or watery solutions penetrates the skin only to the stratum cornuum, as do other germicides. It is not to be expected of any of them that they can penetrate all the layers of the skin in sufficient strength to kill any of the more resistant bacteria. A certain degree of systemic absorption is said to occur, even to the point of intoxication, when applied over large areas, but it is hardly possible that germicidal properties in such dilutions have been preserved. Intoxication in any degree I have never observed even where very large surfaces were covered.

Portions of the skin were examined after treatment with 5 per cent. picric solution in 95 per cent. alcohol by means of frozen sections. The penetrating power is practically that of iodine. It must be remembered, however, that picric acid is an excellent mordant and decalcifying reagent, and its germicidal properties may last longer and extend farther for that very reason.

Skin scrapings were made after the use of the 5 per cent. picric acid solution in over thirty operative wounds. After the skin incisions were made the whole depth of the skin was thoroughly, deeply, and repeatedly scraped with a scalpel, taking care to avoid blood but endeavoring to obtain as much skin *débris* as possible. These scrapings were placed in broth tubes and then transferred to large broth flasks, so that the picric acid present might be diluted beyond any possible germicidal or even

antiseptic action. Moreover, these cultures were observed over periods of at least nine days in order that bacteria deeply hidden in the tissues might have every opportunity to develop.

Of the 27 cases in which we have been able to obtain the final result 16 were reported sterile throughout, while 11 gave growths of various kinds as follows: Staphylococcus albus, 5 times; staphylococcus albus and diphtheroids, 1; bacillus subtilis, 3; gram-positive bacillus, 2.

These results are about what one would expect when it is considered how thoroughly and deeply the skin scrapings were made. It is interesting to note that a similar experiment was carried out by a member of the house staff, who made repeated superficial skin scrapings on himself to the corium, using alcoholic picric acid in one series and iodine in a second series. All his cultures remained sterile.

It may be of some interest, although of no real scientific value, to state that of the 16 skin wounds reported sterile, 13 healed by primary union, 2 showed slight infection, and 1 had a moderately severe necrosis of the subcutaneous fat. Of the 11 cases which were reported not sterile, 8 resulted in primary union and 3 gave a slight infection. There was 1 infection in the wound which had been reported positive for staphylococcus albus, 1 positive for bacillus subtilis and 1 for the large gram-positive bacillus. These results are of no real significance, as the cases were unselected and were frequently contaminated at the time of operation.

It is not possible to conclude anything of positive value from the skin scrapings as to the efficacy of picric acid, except that, as was well known previously, no antiseptic penetrates all the layers of the skin with real germicidal power. In my opinion, the chief value of picric acid lies not in its germicidal power, but in its tanning qualities. I believe the bacteria are mechanically caught and held in the thick pellicle of tanned skin which develops after the use of picric acid. This prevents the bacteria from readily entering wounds during the operative procedure and holds them enmeshed until the wound is sealed. The condition of the lips of the wound at the end of operation is markedly different from that seen after the use of iodine. In the latter case the iodine is largely gone, into the wound, on the towels, sponges, etc., but with picric acid this is not so, practically all being present, no matter how long the operation. Indeed, one of the chief objections to its use is the difficulty of removing the stain.

A number of attempts have been made to find some reagent which would remove picric stain from the skin, but so far none with any great promise. Any of the sodium hypochlorite solutions will act, but slowly. The lime-and-soda scrub is more efficacious but hardly applicable where most needed, *i.e.*, on the face, neck and ears. Towels, dressings, etc., are readily decolorized by simple washing in cold water.

Professor Gibson has recently called my attention to the marked im-

provement in the end-results of our chronic appendicitis cases[1] since the introduction of the picric-acid technic. In former years our percentage of bad results in these cases was very high, running about 28 per cent. Since the introduction of the picric-acid preparation the percentage has dropped from 28 to 20 in 1918, and 11 in 1919. It was noticeable, also, that the great majority of these cases complained of pain in the immediate neighborhood of the incision, presumably due to adhesions. These complaints have become markedly less during the past two years. The criticism may be made, that our better results are due to other factors; but our technic has remained identical, with the exception of the introduction of picric acid, and it is hard to believe that diagnostic acumen and operative skill have increased to any such marked degree.

In conclusion, picric acid is ideal as a skin application preceding operation in that it never irritates and that it remains in the skin for a long period of time. Its only drawback is its rather startling color, which may annoy sensitive patients when exposed surfaces are stained. From the clinical standpoint, our results compare very favorably with those formerly obtained with iodine and with the older methods of skin preparation. I am fully aware, however, of the pitfalls of clinical observations uncontrolled by laboratory findings.

All methods of skin sterilization must necessarily fail of complete satisfaction. We are forced to employ those which experience proves reasonably satisfactory until such time as the bacteriologists perfect a universal or polyvalent immunization agent, to prevent and control sepsis from whatever source.

I wish to extend my grateful thanks to Doctors Stillman, Wheeler, and Spencer, of the Laboratory Staff of the New York Hospital, and to Doctors Kingery and Durfee, of the House Staff, for valuable aid in the technical part of this work.

Résumé of Bacteriological Procedures

The tests to be described were carried out with samples of tincture of iodine and of 5 per cent. picric acid in 95 per cent. alcohol obtained from stock solutions in the operating room.

The phenol coëfficients of these two solutions were determined by the United States Hygienic Laboratory method. With no organic matter present, the 5 per cent. picric acid solution had a phenol coëfficient of 0.35; the tincture of iodine, a coëfficient of 15.5. In the presence of organic matter—gelatin and peptone—the coëfficients were

[1] Year	Per Cent. Unsatisfactory	Year	Per Cent. Unsatisfactory
1913	28	1917	24
1914	23	1918	20
1915	28	1919 (6 months)	11
1916	26		

[1] Gibson, Charles L.: The Results of Operations for Chronic Appendicitis. Am. Journ. Medical Sciences, May, 1920, No. 5, vol. clix, p. 655.

0.2 for the 5 per cent. picric acid solution and 12.5 for the tincture of iodine. A control test with 95 per cent. alcohol, no organic matter present, showed a coëfficient of 0.15.

In determinations of this kind, intimate contact between the disinfectant and the test organism is assured, since they are mixed in a liquid medium and thoroughly shaken. The results obtained, however, give little information as to the efficacy of the disinfectant when applied to the skin, for in the latter case contact between disinfectant and organism depends upon the penetrating power of the solution, upon its ability to reach organisms that may be underneath the superficial layer of cells, in the ducts of sweat glands or in hair follicles.

In order to make the conditions of the tests conform more closely to those that obtain when these disinfectants are used for skin sterilization, the method devised by Elser and described by Connell[2] was employed. In this method the results depend upon the ability of the disinfectant to penetrate non-liquid culture media. Culture tubes of uniform calibre containing standard nutrient agar medium are inoculated, while the medium is liquid at 45 degrees Centigrade, with equal amounts of a 24-hour culture of staphylococcus aureus. After thorough mixing the medium is allowed to solidify. Equal quantities of the disinfectants to be tested are then added to the tubes, the cotton plugs are paraffined to prevent evaporation of the alcohol, and the cultures are incubated at 37 degrees Centigrade for 24 hours. A control culture to which no disinfectant has been added shows a uniform growth throughout the entire column of agar. The inhibiting effect of the disinfectant solution is shown by an absence of growth in that part of the medium nearest the disinfectant—that is, in the upper part of the agar column—and comparisons between different solutions may be made by comparing the heights of these zones in which no growth occurs.

Four disinfectants were tested by this method with the following results, the heights of the inhibited zones being expressed in millimetres:

1. 5 per cent. picric acid in 95 per cent. alcohol:
   - Undiluted ..... 12 mm.
   - 1–10 ..... 3 mm.
   - 1–50 ..... 1 mm.
2. Tincture of iodine, 7 per cent.:
   - Undiluted ..... 13 mm.
   - 1–10 ..... 4 mm.
   - 1–50 ..... 2 mm.
3. Alcohol, 95 per cent.:
   - Undiluted ..... 10 mm.
   - 1–10 ..... 2 mm.
   - 1–50 .....No inhibition of growth.
4. Phenol in aqueous solution:
   - 1–20 ..... 2 mm.
   - 1–50 .....No inhibition of growth.

All dilutions were made with sterile, distilled water.

These results indicate that the practical value of a disinfectant may be more accurately estimated from a study of its penetrating power than from its bactericidal properties, as determined by phenol coëfficient tests. The solvent employed in making such solutions also has an important bearing upon their action; iodine, when mixed with sterile vaseline in proportions of from 0.5 per cent. to 2.0 per cent., shows no inhibiting effect when tested in the manner just described.

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[2] Connell, Karl: A New Disinfectant. Surg., Gyn. and Obst., July, 1918, vol. 27, p. 81.

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
April, 1921.

THE GIBSON-MIKULICZ TAMPON IN ACUTE APPENDICITIS *

By Charles E. Farr, M.D.
of New York, N. Y.

The subject of drainage in acute inflammatory processes is, and always has been, vigorously debated. In no field is this more true than in acute appendicitis. Men of great experience and skill in abdominal surgery differ to the widest extremes in this respect. Some never drain unless forced to, and then only with the smallest possible material through a counter-opening; others use rubber tubes, glass tubes, large cigarette drains, etc.; a few pack the wound wide open with gauze.

Aside from the question of weak scar, intraperitoneal adhesions, and slow healing, few would object to leaving these infected wounds wide open. This is the rational and accepted procedure in other parts of the body and would unquestionably be used here except for these three objections.

The peritoneum has such marked resisting power to infection that great liberties may be taken with it in certain cases, a fact which explains the excellent results of our more radical confrères. There is, however, a sharp limit in this direction, and all of us now agree, I believe, that certain types of appendicitis require drainage. The question of which cases to drain and the means to employ are still subject to debate.

On the Cornell Division of the New York Hospital, in the service of Dr. Charles L. Gibson, it has been the custom not to drain when the stump of the appendix could be inverted or securely ligated and when there was little or no extension of the inflammation beyond the appendix proper. A moderate amount of turbid serum is not a positive indication for drainage. However, any odor to the exudate makes drainage imperative, in our opinion. Oozing, not readily controlled, even in a case otherwise acceptable for closure, also demands drainage.

As a general rule we drain when in doubt and, in the doubtful cases, use only a small cigarette or folded rubber dam, inserted to the base of the appendix. This is almost invariably done through the laparotomy wound, as we rarely, if ever, use a stab wound drain. Such drains are extracted in twenty-four or forty-eight hours, and primary healing is the usual result. Occasionally, however, through misjudging the case and the amount of drainage needed, a fairly severe infection ensues. This is also true at times in cases sewed up tight. The infecting power of the appendix has been made a subject of careful study during the past two years and will be reported in a subsequent paper.

* Read before the Surgical Section of the New York Academy of Medicine, February 4, 1921.

In the more severe types of appendicitis, with widespread peritonitis, or large foul abscesses, especially the retrocæcal and pelvic types, we have employed, following the custom introduced by Doctor Gibson, the modified Mikulicz tampon. At times a few sutures are introduced in the parietes, but in general none are used. A firm pack of plain gauze inside the rubber dam is sufficient to wall back the intestine and a careful adhesive strapping prevents the expulsion of the whole mass with the bowel.

A review of all the cases of acute appendicitis occurring in the ward service of the Cornell Division during the years August 1, 1914, to August, 1920, has been made, numbering 818. Of these a large proportion, presumably 50 per cent., were closed without drainage. A smaller number were closed partially, using cigarette or folded rubber dam or rubber tube drain, and 162, or 19.8 per cent., were dressed with the Mikulicz tampon.

The mortality in the entire series was 34, or 4.15 per cent. In the Mikulicz cases it was 20, or 12.3 per cent.

It would of course be unfair to compare the Mikulicz series with the other acute cases as only the very severe types received the former treatment. A comparison of a Mikulicz series with another similar group of extreme cases treated by the usual forms of drainage, by the same operators, would be of some value, but unfortunately is unavailable. Comparison with other operators is of little worth because of variations in individual skill and judgment, especially in the classification of cases.

The post-operative course of the Mikulicz cases is of considerable interest. In the great majority there is an almost immediate cessation of the acute abdominal and systemic symptoms and convalescence is remarkably smooth. Dressings are practically painless. The parietes never undergo phlegmonous infiltration. Sloughing of the aponeurosis is rare. The wounds clean up superficially very quickly and cease discharging about the fourteenth day. Healing to a superficial granulating area occurs from the twenty-first to the thirty-fifth day, when the patients are allowed to leave the hospital. Complete healing occurs, as in all intraäbdominal cases, at varying periods, depending on intraperitoneal conditions largely. Stitch sinuses are of course not seen.

It is well known that drainage of the general peritoneal cavity cannot be maintained more than forty-eight hours, but one has only to see the enormous amounts of secretion on the Mikulicz dressings for the first seventy-two hours to realize that something, presumably an injurious agent, is being eliminated. Taken in conjunction with the clinical manifestations, we feel that beyond reasonable doubt, our patients are relieved of their toxæmia by this thorough elimination. We feel that this factor occasionally turns the scale in critical cases.

Pocketing or residual abscess is rare under this treatment. When it does occur, relief is usually easy without an anæsthetic. A gloved finger in the wound quickly finds the encysted collection and induces free drainage.

By the fourth day the pack is usually entirely removed, the rubber dam

or a fresh one, inserted, and measures conducive to cleansing the wound are instituted. The Carrel-Dakin treatment has given good results at this stage.

Evisceration has occurred very rarely and almost, if not entirely, in moribund cases. These seem to have little or no power to form adhesions and evisceration occurs as it does even in sutured wounds.

No attempts have been made at secondary suture in these cases. They have been strapped when clean, allowed to heal, and kept under observation for a year. At first the scars are linear and not easily told from sutured wounds, but gradually they hypertrophy and broaden out. A certain number develop hernia, usually a small affair and easily remedied. A few have been more extensive but in none has the repair been difficult, since no aponeurosis is lost.

An interesting feature of the repair has been the study of intraperitoneal conditions. We have been greatly impressed with the absence of adhesions of any moment and attribute this to the prompt alleviation of the local peritoneal suppuration.

CONCLUSIONS

We have no comparative statistics to offer that would be of any value, but we are quite sure from careful observation over a period of years and a considerable series of cases, that the Gibson tampon does lessen mortality in the very severe type of cases. We feel also that it lessens morbidity and suffering and that the number of post-operative hernias is no greater than in other forms of treatment, that the hospital stay is no longer, that the conditions of the wound and the intraperitoneal conditions are better than by any other form of drainage. If these things are true, the tampon, as improved by Doctor Gibson, is a real step in advance in the treatment of the more severe types of appendicitis.

I am greatly indebted to Doctor Gibson for the privilege of reporting these cases, all of which were operated upon in his service by the various members of the staff. I would also gratefully acknowledge the help received from Dr. John Lyttle for his help in compiling these statistics.

ACUTE APPENDICITIS—GIBSON-MIKULICZ TAMPON—ONE HUNDRED AND SIXTY-TWO CASES

Deaths, 20—12.3 per cent.

Excluding deaths, 142 cases; average stay in hospital, 22.4 days.

Shortest stay in hospital, 8 days.

Longest stay in hospital, 63 days.

Incision:

Intermusc., 74, or 52.1 per cent., average stay in hospital, 19.3 days.

Split rectus, 42, or 29.8 per cent., average stay in hospital, 25.5 days.

Rectus retracted, 26, or 18.1 per cent., average stay in hospital, 23.5 days.

Three reoperations for miscellaneous conditions, abscess, sinus and T.B. peritonitis.

Evisceration, 1; died on third day.

Repair—all successful.

MIKULICZ CASES

Total cases, 162.
Deaths, 20, or 12.3 per cent.
No follow-up record, 22, which leaves 120 cases to be considered.
Hernias occurred in 21 cases, or 17.5 per cent.
Reoperation in 12 cases, or 57.1 per cent.

Incisions:

Intermusc., 62, or 51.6 per cent., gave 13 hernias—20.9 per cent.
Split rectus, 34, or 28.3 per cent., gave 7 hernias—20.5 per cent.
Rectus retracted, 24, or 20.1 per cent., gave 1 hernia—4.1 per cent.

Incisions in 21 hernia cases:

Intermusc., 13, or 61.9 per cent.
Split rectus, 7, or 33.2 per cent.
Rectus retracted, 1, or 4.9 per cent.

REPRINTED FROM
ANNALS OF SURGERY
227 South Sixth Street, Philadelphia, Penna.
JUNE, 1921.

CULTURES FROM THE APPENDIX

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(From the Laboratory of Surgical Pathology of Cornell University Medical School)

THE problem studied in this paper is the infectiousness of the appendix. It is well known in a general way that the appendix is an infected organ, and that from it arise infections of the peritoneum and its contained organs and of the abdominal parietes during operative procedures.

This paper does not deal with the etiology of appendicitis, but with the bacterial content of the exterior of the appendix, and the mesoappendix, with its blood-vessels and lymphatics. It may be and probably is true that the organisms so isolated play a large rôle in the etiology of appendicitis, but the problem at hand was to determine the potential threat of the appendix to the peritoneum, its viscera, and the abdominal wall.

For the purposes of this study a consecutive series of appendices was chosen, including both chronic and acute cases but excluding all cases of perforation and of gross peritoneal infection. All of these cases were operated upon by me in the service of Dr. Charles L. Gibson at the New York Hospital, First Surgical, or Cornell Division. Cases showing perforation or peritoneal involvement were excluded because the true infecting organism is so quickly overgrown in such instances by colon and other hardier bacteria.

The technic followed was division of the crushed base of the appendix between clamps, with the cautery. Two small Kocher clamps are used, set as closely together as possible and well clamped. They are then rolled apart about one-quarter inch, leaving only a thin ribbon of peritoneum and muscularis to cauterize. In this way gross contamination of the field is fairly well provided against. The meso is divided before or after this step, according to convenience, and the appendix with the removed meso is at once dipped entirely beneath the surface of a broth culture tube, shaken gently, and removed. The cultures were then incubated and studied in the usual manner. No anaërobic studies were made. I am greatly indebted to Dr. George Wheeler, bacteriologist to the hospital, for his unfailing courtesy and friendly interest in the work.

The number and variety of infecting organisms may be noted in the accompanying chart. Conclusions must not be drawn from such a limited series of cases as to the etiology of appendicitis, nor the relative frequency of the various types of bacteria in and about the appendix. It does show, however, that the appendix is a contaminated organ, even

when there is not the slightest sign of acute infection, and that with the most careful technic, infection of the peritoneum and the abdominal parietes may ensue. Only the marked resistance of normal tissues to bacterial invasion prevents more frequent post-operative mishaps.

The subjoined table of 131 consecutive cases shows the colon bacillus, alone or with other organisms, in 57 per cent. of the appendices. Of the 45 acute cases the colon bacillus, alone or mixed, is present in 53 per cent. No other single bacterium appears in any large number of cases. Eighteen appendices gave no cultural growth. The two infected wounds of 36 acute cases closed without drainage (giving 5.5 per cent. infections); each showed the colon bacillus.

Of the 131 cases, 113, or 86 per cent., gave some form of growth; 122 were closed without drainage. Primary union was obtained in 117 (96 per cent.). Two hæmatomas, both sterile, appeared; one in a chronic appendix case, the other in a prophylactic appendectomy. One abscess of the parietes appeared in a prophylactic appendectomy. The culture showed staphylococcus albus, probably a skin contamination. Two of the acute cases developed a parietal abscess on the seventh post-operative day.

CONCLUSIONS

The appendix is potentially an infecting agent even when the most careful technic is used. Too much care cannot be exercised in delivering and removing it. Occasional parietal and deep-seated infections will occur under the most approved technic.

My most grateful thanks are due to Doctor Gibson for the privilege of operating upon and reporting these cases and to Doctor Wieden of the House Staff for aid in preparing the data.

Total	Chronic appendix. Primary union	Chronic appendix. Hæmatoma of wound	Prophylactic appendectomy. Primary union	Prophylactic appendectomy. Hæmatoma of wound or abscess of wound	Acute appendix. Primary union	Acute appendix. Drained wounds	Acute appendix. Seventh-day infections	Dr. Chas. E. Farr 131 Cases
50	17	1	14		13	3	2	Gram neg. bacillus of colon group
1	1							Same + Gram positive cocci
2	1			1				Same + diphtheroid bacillus
1	1							Same + staphylococcus albus
2	2							Same + staphylococcus aureus
1					1			Same + non-hemolytic streptococcus
11	4		4		2	1		Bacillus coli communis
1	1							Same + staphylococcus aureus bac. proteus
1					1			Same + bac. lactis aërogenes
1			1					Same + staphylococcus albus
4	3				1			Bacillus coli communior
4	1		1		2			Staphylococcus aureus
1					1			Same + non-hemolytic streptococcus
9	3		2		3			Diphtheroid bacillus
2	2							Bacillus pyocyaneus
7	1		5		1			Staphylococcus albus
1			1					Same + diphtheroid bacillus
1					1			Gram neg. bacillus producing no gas and fermenting no sugar (contaminated)
4	3				1			Bacillus alkaligines
3	1		1		1			Bacillus proteus
4	3				1			Contaminated with bacillus subtilis
2	2		2					Contaminated
18	7		2		2			No growth
131	50	1	33	2	34	3	2	Total

REPRINTED FROM

ANNALS OF SURGERY

227 South Sixth Street, Philadelphia, Penna.

MAY, 1923.

ISCHÆMIC FAT NECROSIS*

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FAT necrosis apart from pancreatic disease is generally considered an exceedingly rare condition, while subcutaneous fat necrosis even in pancreatic disease is rather exceptional. The following case, therefore, should be of double value and interest:

Case Report.—CASE I.—A. E. P., aged four weeks, was referred to the First Surgical Division of the New York Hospital on December 19, 1912, by Doctor May of the Medical Clinic, for treatment of a paralysis of the left arm and because of certain peculiar subcutaneous tumors of the neck and shoulders.

Family History.—Father and mother alive and well. They are Russian Poles but have lived in this country several years. Two living children, both well. One stillbirth, one infant died of summer complaint. No miscarriages. The present child and the stillbirth were instrumental deliveries. No history of syphilis or tuberculosis could be obtained.

Present History.—The child was born after a labor of eighteen hours duration and a very difficult and tedious instrumental delivery. It was a vertex presentation: the other details are unknown. On the second day it was noticed that the left arm was completely paralyzed and that there were marked discolorations over the neck and shoulders. These cleared up in a few days and the child appeared perfectly healthy except for the paralysis. It was strong and vigorous and took the breast well. Hospital treatment was sought because of the paralysis of the arm, the parents not having noted anything else abnormal.

Physical Examination.—A healthy female child weighing about eight pounds and presenting no evidence of trouble except a flaccid paralysis of the left arm and hand, probably due to birth trauma, and a very slight rash on the face. On palpation, however, a large number of subcutaneous tumors were found over the neck and shoulders, extending as high as the submaxillary region and as low as the seventh rib posteriorly. These tumor masses were of irregular shape and varying sizes from one-half cm. to five cm. in diameter, and for the most part oval in shape, although one or two were sausage-like masses. Their consistency was considerably firmer than the surrounding normal fat. There was no evidence of pain, tenderness, nor any inflammatory signs whatever. The tumors were adherent to the skin, but were freely movable on the underlying tissues. The largest masses were found over the deltoid, supra- and infraspinatus regions. Various diagnoses were considered but the one

* Read before The New York Surgical Society, February 14, 1923.

finally accepted was multiple congenital lipomata or, possibly, some condition of unaltered embryonal fat.

Under cocaine anæsthesia an oval piece of skin and subcutaneous fat was excised from the left supraspinatus region, including a portion of one of the larger tumors. The wound was sutured and healed by primary union. The child improved rapidly while under observation, although the condition of the left arm showed no change. The multiple tumors were definitely growing smaller when the child was taken from the clinic at the end of four weeks.

Pathologic Examination, Gross.—The tissue removed from the shoulder consisted of skin, subcutaneous fat and a portion of one of the larger tumor

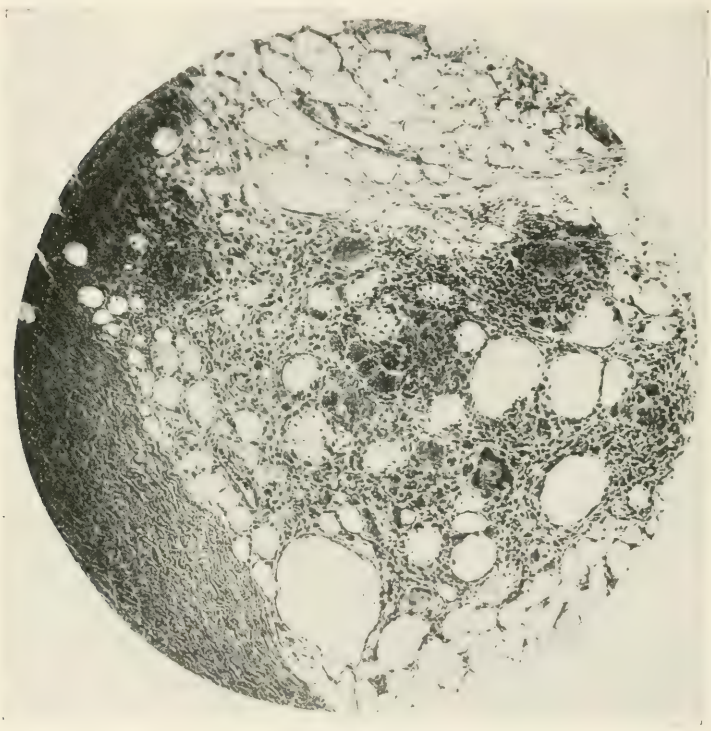

FIG. 1.—Fat necrosis, infant.

masses. Upon section, the tumor tissue was seen to be fairly sharply defined from the surrounding fat, into which it extended about one and one-half cm. in depth. The color was a dull grayish-white, harder than the normal fat, opaque and of homogeneous appearance. The diagnosis at this time was not evident, as the lesion was not unlike a new growth in appearance. Syphilis and tuberculosis were considered but some form of fat tumor was considered more probable.

Microscopic.—Part of the tumor tissue was immediately injected into a guinea pig and the rest was sectioned at once by Doctor Elser. Frozen sections were stained with hæmatoxylon and eosin and showed under the microscope a most beautiful picture of subcutaneous fat necrosis in a fairly advanced stage of repair, with considerable round cell infiltration and formation of new connective tissue but more especially the presence of innumerable giant cells of the irritation or foreign body. (Fig. 1.) Everywhere throughout the specimen the

necrotic fat spaces were filled with bundles of fatty acid crystals. In other words the picture was typical of fat necrosis of the type usually considered pancreatic in origin. Sections stained and examined for bacteria showed none present. The pig into which a portion of the tissue had been introduced remained perfectly well for four months and on autopsy showed no lesions whatever.

This case is then one of the very infrequent cases of subcutaneous fat necrosis and is the only one, so far as a careful search of the literature shows, in an infant. Considering the weight and age of the child, it is also probably the most extensive case on record of fat necrosis with recovery.

Stimulated by these unusual findings and by the friendly interest of Doctor Elser, I sought to determine, so far as possible, the origin of the lesion, its frequency and the results. Inquiry was made of numerous pathologists, obstetricians and pediatrists as to similar observations, with entirely negative results, although Dr. Horst Oertel stated that he had not infrequently seen necrosis of the abdominal fat in obese subjects, following laparotomy. Through the kindness of Dr. Edward Truesdell, forty new-born infants were examined at the New York Lying-in Hospital, again with negative findings. It should be observed, however, that none showed evidence of severe traumatism at birth.

Through the courtesy of Professors Elser and Ewing, the attempt was then made to reproduce experimentally the lesions of fat necrosis, by traumatism, in the Laboratory of Surgical Pathology of the Cornell University Medical School.

Experiment I.—Sterile normal subcutaneous fat obtained at operation for inguinal hernia in a young child was divided into two portions. One part was placed in a thermostat at 37 C. for two days. At the end of this time, smears in a drop of water showed fairly numerous crystals of fatty acid. The second portion was kept in two per cent. formol at room temperature for 25 days, at the end of which period smears both from the surface and from the interior showed very numerous crystals of fatty acid.

Experiment II.—The repetition of the above, using fat from an obese old lady and keeping it ten days at 37 C. Smears showed almost complete change into fatty acid crystals and fine fat droplets.

From these two simple procedures, which of course are not original, it may be concluded that fat is a very unstable substance and that it readily splits into fatty acid and glycerine without any extraneous aid. It should be noted that no macroscopic blood was present in the fat. The presence of a fat splitting ferment in the blood as well as in the fat itself has long been known.

Experiment III.—A healthy female pig about six weeks old and weighing about twenty pounds was then obtained; its shoulders shaved and the skin and subcutaneous fat traumatised in seven places by means of strong pincers, whose jaws were guarded with rubber to prevent abrasion of the skin proper. A piece of normal skin and subcutaneous tissue was removed as a control as well as one of the traumatised areas. The other pieces of traumatised tissue were removed at subsequent periods as shown below.

(a) Piece of normal fat—careful examination of smears showed no crystals. No evidence of necrosis. This tissue was then placed in 10 per cent. formol and

kept at room temperature for 28 days. A smear from surface scraping then showed an occasional typical fatty acid crystal. From this it may be concluded that fat splitting can take place to a slight extent even in the presence of a powerful antiseptic, and is presumably then not a biochemical phenomenon.

(b) The traumatised piece of tissue removed immediately was examined at once by scrapings, and showed only fine oil droplets and fat cells. There were no crystals. Placed in 10 per cent. formol and kept at room temperature 30 days it showed fairly numerous fat crystals in the smears. No evidence of necrosis.

(c) Tissue removed 48 hours after traumatism showed only oil droplets in finely divided state and no crystals. No evidence of necrosis although fat seemed softer than normal. Again examined at the end of 28 days in 10 per cent. formol, a very few typical crystals were found after prolonged searching.

(d) Tissue removed in four days with exactly the same findings. At the end of 26 days fairly numerous fatty acid crystals were found in scrapings. No evidence of necrosis.

(e) Tissue removed at the end of 6 days showed in one place a brownish discoloration nearly a centimeter in diameter, evidently a spot of hemorrhage and necrosis. Scrapings made at once from the normal appearing fat showed no crystals, but at the end of 24 days fairly numerous fatty acid crystals were found in the same tissue. The stained sections will be described later.

(f) Tissue removed 8 days after the traumatism. No evidence of necrosis. Fatty acid crystals were not found at once, but were very numerous in the scrapings at the end of 22 days.

(g) Tissue removed at the end of 14 days. Gross appearance not markedly different from the others. Scrapings taken immediately showed no fatty acid crystals. No evidence of necrosis. At the end of 16 days numerous crystals were found.

(h) A piece of tissue including the suture line of one of the first incisions was removed at the same time as specimen (g). Necrosis was present around the sutures (which were of horse-hair and had been in place about two weeks). No evidence of infection. Scrapings from about the suture marks showed numerous typical fatty acid crystals.

It should be observed in explanation of the somewhat irregular and inconstant findings above, that the writer was quite inexperienced in laboratory technic, and that the traumatism inflicted was of a very mild and inconstant nature. The rubber guarded jaws tended to slip easily on the somewhat greasy surface of the pig's skin and the amount of pressure exerted was not severe and was quite irregular. Moreover, although the traumatised places were marked with carbol fuchsin, the stain faded fairly soon, and not improbably the places really traumatised were not excised at times.

Experiment IV.—With the pig under deep ether anæsthesia, a piece of skin and subcutaneous tissue was squeezed firmly with the guarded pincers for about five minutes, and carefully marked. At the end of 26 days this piece was excised and a small but distinctly indurated mass could be felt in the centre. On section, a thin-walled cyst was seen, the size of a grain of wheat, and, closely adjacent, a slightly larger area of typical fat necrosis, dull grayish-white in appearance, opaque and somewhat firmer than the surrounding fatty tissue. Scrapings showed numerous fatty acid crystals.

Frozen sections were made from the tissue (e) Experiment III, and from the specimen removed in (d), and stained in various ways, hæmatoxylon and eosin, Nile blue, Benda's stain, Sudan III, etc., and showed typical fat necrosis in each. The section from (e) was of course at a much earlier stage

and showed considerable interstitial hemorrhage: innumerable fatty acid crystals appeared in the necrosed cells and only a moderate tissue reaction (6 days duration), with no typical giant cells.

The section from Experiment IV, after 26 days, showed a thin-walled recent cyst, lined with connective tissue only, and close by an area of marked tissue reaction, new formed fibrous tissue, very numerous giant cells of the irritation or foreign body type, and considerable round cell infiltration. Fat in all stages of cellular necrosis was beautifully shown by the various stains. Innumerable crystals of fatty acid were everywhere present in this area, usually

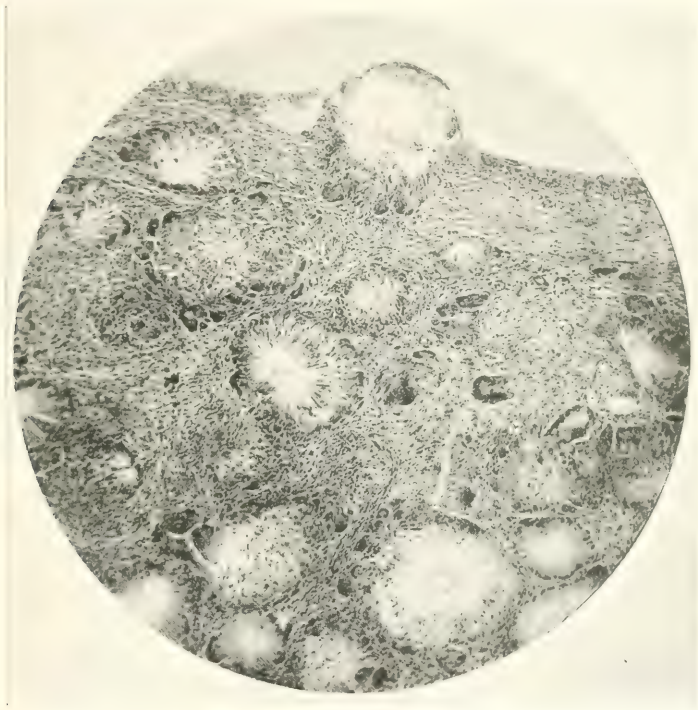

FIG. 2.—Fat necrosis, pig.

in the fat cells. There were other amorphous areas, rather deeply stained with hæmatoxylon, which were apparently calcium soaps of the fatty acids. No calcification proper was seen. (Fig. 2.)

A number of the various specimens removed were blocked in paraffin and sectioned and stained in various ways, but with the exception of the two places mentioned above, only doubtful evidence of true fat necrosis was seen.

It is only just to the pig to state that he remained perfectly well throughout the experience, all his small wounds healed by primary union, and he doubled in weight in the seven weeks he was under observation.

It may be concluded from the above that fat necrosis is rather easily produced by simple trauma, and that fat necrosis and fat splitting are two quite different processes, frequently allied, to be sure, but not necessarily so. Necrosis is the principal event, fat splitting being only an accompaniment and

probably readily occurring independently in the living or dead fat cell. Certainly in the case reported and in the experimental work one can safely exclude any pancreatic disease, or any infectious process in the fat. This leaves two possible theories of causation, (1) enzyme action from liberated blood or from the fat cell itself, (2) simple pressure necrosis from anemia with secondary fat splitting. Probably both factors take part in the process, but it is not necessary to postulate enzyme action at all for its production.

An attempt was made to determine the activity of enzyme reaction in the presence of such a strong antiseptic and germicide as formalin in 10 per cent. solution. Ethyl butyrate was chosen as the agent and glycerole extract of pancreas for the enzyme. Experiments were conducted as follows:

A. 1. Ten c.c. H_2O plus 1 c.c. E. B. plus two drops litmus plus NaOH n/100 qs. ad alkalinity (2/10 c.c.).

2. Ten c.c. H_2O plus 2 drops litmus plus NaOH n/100 qs. alkalinity plus pancreas extract, drops 3.

3. Ten c.c. formol (10 per cent.) plus c.c. E. B. plus litmus plus 3 drops pancreas extract plus NaOH n/100 qs.

4. Ten c.c. formol (10 per cent.) plus 1 c.c. E. B., litmus, plus NaOH n/100 qs.

These four solutions were placed in a thermostat at 37 degrees C. and observed at various periods for 24 hours.

All remained alkaline in reaction except No. 2, which showed a strong acid reaction at the end of 21 hours. This experiment was repeated three times to insure accuracy, the results being indentical at each trial.

B. Using saliva and soluble starch for the reagents, the following experiments were conducted:—

1. Saliva plus H_2O plus starch.

2. Saliva plus formol (20 per cent.) in equal volume plus starch. These were incubated at 37 degrees C. In (1) at the end of 45 minutes there was a slight reduction to Fehlings. In 20 hours there was a heavy reduction to Fehlings, a nearly complete reduction, with slight formation on erythro- and achroödextrin.

In (2) at the end of 45 minutes, there were slight reduction to Fehlings and considerable erythro- and achroödextrin but no glucosazone. It was then found that formol itself would reduce Fehlings and the tests were therefore repeated, using formol and starch, and formol, starch and saliva respectively. Benedict's test for sugar was negative in each, at the end of 20 hours.

Similar tests were conducted with milk, pancreas extract and formol (10 per cent.); with ethyl butyrate, pancreas and formol, etc., and the results were identical in each test—namely, that formol in 10 per cent. solution inhibits the action of the fat splitting enzyme of the pancreas, and the ptyalin of the saliva.

From these experiments it seems fair to conclude that the fat splitting repeatedly observed to occur in the presence of 10 per cent. formol solution is not due to enzyme action, but to the fact, that fat is very unstable and easily breaks down into its constituent fatty acids and glycerole. The weak point in the argument, of course, is that the surface film of oil on the specimens would prevent the full action of the formol on the tissue enzymes. As, however, the pieces of tissue used were very small and as the surface scraping in each instance showed fatty acid crystals, this objection is not a very strong one.

The ultimate fate of these foci of necrosis is of considerable interest.

Korte, at a cholecystotomy found a widespread intra-abdominal fat necrosis, while at a subsequent laparotomy for common duct stones, a year later, no trace of it was to be seen. On the other hand, Lubarsh and Ostertag found that such foci usually calcified just as the fatty acids in old tuberculous foci, in cysts, etc., calcified. In this connection a recent observation of Webber is of interest: A seven year old girl presented multiple calcified foci in the subcutaneous fat of the trunk and extremities. New ones had formed during the past year. The von Pirquet and Wassermann tests were negative and microscopical examination of an excised fragment showed only calcareous material with no tuberculous nor luetic involvement. Although Webber does not establish a certain diagnosis, this would appear to be a case of multiple subcutaneous fat necrosis of unknown origin.

Case II.—E. C., French maid, twenty-five years of age, admitted to the New York Hospital, out-patient department, Cornell division, September 27, 1913, complaining of a painful swelling in the right thigh. Her family history was negative, and the only previous illness was a severe fever of 11 days duration, a year previously in a French hospital. At that time she received hypodermics of camphorated oil, 2 in the right thigh, 1 in the left. She has had pain in the right thigh ever since, especially on becoming tired and has noticed a small swelling at the site of the hypodermic injection.

Examination revealed nothing abnormal except an indurated swelling 5 cm. in diameter and 1 cm. in depth in the middle of the antero-external surface of the right thigh, attached to the skin, but freely movable on the fascia lata. The swelling is flat, tender, not discolored, and shows no signs of inflammation. On being rolled between the fingers and thumb, it presents a typical pig-skin appearance with coarse follicles. As the condition was evidently causing no great discomfort expectant treatment was advised. Nothing has been heard from her since. The case is evidently one of subcutaneous fat necrosis by irritant chemical action. The result will probably be a cyst or calcareous deposits.

Case III.—J. J. B., male, thirty-nine years of age, chief complaint, a painful rapidly growing swelling in the left thigh. Family history negative, previous history negative except that he has been a heavy drinker and has had "attacks of rheumatism." Present history: Thirty-five years ago, at the age of four, patient was struck by a street car, receiving a severe contusion on the left thigh. He was treated by the family physician and recovered promptly. There was no fracture. Ever since this injury, he has had a hard, painless flat swelling over the antero-external surface of the left thigh, near its middle. This caused no inconvenience nor symptoms until two months ago, when the lump was contused by falling lumber. Since then the swelling has increased in size and become very tender.

Examination revealed a vigorous, healthy working man with a swelling on the antero-external surface of the left thigh about its middle, attached to the skin, and to the fascia lata. The swelling was not discolored, but was slightly tender on manipulation. It was about 10 cm. in diameter and raised 1 cm. above the surrounding skin. It was extremely hard, evidently calcareous, except at its centre, which presented an area of fluctuation about 3 cm. in diameter. The diagnosis was in doubt as malignancy could not be excluded, but the opinion was expressed that the condition was a calcareous degeneration of a subcutaneous lipoma.

Under ether anæsthesia, April 14, 1914, the tumor was completely excised, including a large area of skin, fat, and fascia lata, which was markedly involved. The wound healed per primam and the patient has been perfectly well since. Examination of the specimen showed multiple, thick-walled cysts surrounded by dense fibrous tissue and large calcareous deposits. (Fig. 3.) The content of the cyst was a peculiar opaque, white liquid, very thick, and strikingly like white lead in appearance. In places this was replaced by semi-solid material, like caseating tuberculosis, but distinctly different in color. Microscopical examination of the cyst walls showed only old fibrous tissue and calcareous deposits. No epithelial lining could be observed. Smears made from the semi-solid areas showed innumerable cholesterin crystals and other amorphous substances, evidently calcium soaps. On treating this substance with strong sulphuric acid, followed by iodine, the cholesterin took on its characteristic purple stain, while the soaps were broken up and fatty acid crystals in great abundance were precipitated.

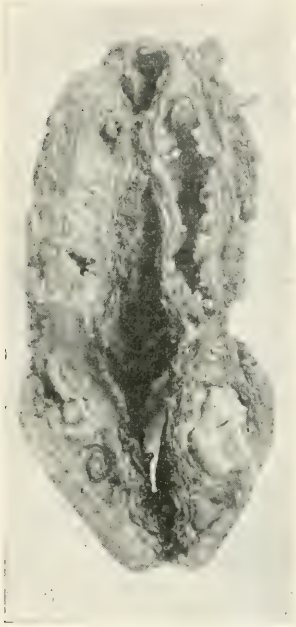

FIG. 3.—Case II. Fat necrosis, adult.

This case is undoubtedly one of subcutaneous fat necrosis by trauma, resulting in cyst formation and calcareous degeneration. There were no evidences of syphilis, tuberculosis, nor malignant disease.

The three cases described, present three stages in the same disease. All occurred in young subjects with abundance of subcutaneous fat. The infant showed necrosis of tissue with fat splitting and the early stage of tissue reaction, innumerable giant cells and beginning fibrous tissue replacement. The conditions present in the young girl, a year after the chemical trauma, are only conjectural, but probably would show large deposits of calcium soaps and marked new formation of fibrous tissue. Case III shows the end result of subcutaneous fat necrosis, with cyst formation, calcareous deposits and masses of cholesterin and calcium soaps.

CASE IV.—F. G., fifty-three years of age, farmer, operated upon in the service of Dr. Alfred Taylor at Fordham Hospital for a large paraumbilical hernia of many years' duration. The family and past history were negative and the hernia was reducible until recently. There had been no injury, or history of abdominal disease. The patient was very obese but otherwise in robust health. At operation, a moderately large omental hernia was found and in the protruding portion just at and outside the ring, were three small calcareous nodules embedded in the fat tissue. The largest was 1 5/10 cm. in greatest diameter. These three nodules were removed and examined with the following results:—Calcium was present in considerable quantity. Carbonates in small quantity. There were also fatty acid crystals, oil droplets, and amorphous bodies, probably soaps. Quantitative analysis by the sulphuric acid—ether extraction showed nearly 30 per cent. of the calculi to consist of fatty acid while soaps were present in considerable amount.

There can be no doubt that this is a case of fat necrosis, but the origin of it is not absolutely clear. In all probability the frequently repeated trauma of passage through the ring and pressure of external objects during heavy labor caused the necrosis, but partial strangulation at the ring cannot be excluded. Pancreatic disease is of course a possibility but not probable. Calcareous degeneration of appendices epiploicæ is not very uncommon, presumably following a fat necrosis of mild degree but not of traumatic origin.

Case V.—Female, about thirty years of age, admitted to the service of Dr. I. S. Haynes, in the Harlem Hospital, and examined by me through his courtesy. There was a history of severe trauma to the right thigh, about 6 weeks previously, followed by a slightly painful swelling in the subcutaneous fat, just above the knee. This swelling was of a peculiar sausage shape, was somewhat tender, attached to the skin, but not to the fascia lata. It was partly excised by Doctor Haynes and pronounced a sarcoma by a competent pathologist. But further examination proved it to be merely an extensive area of fat necrosis with typical giant cells, fat crystals etc. Reproduction of fatty and fibrous tissue was quite pronounced.

Case VI.—O. E., female, thirty-eight years of age, entered the Cornell or First Surgical Division of the New York Hospital, March 3, 1917, complaining of a painful series of subcutaneous tumors in the right deltoid region. The only history we could obtain, was that following a miscarriage three years ago, in Greece, a midwife gave her a hypodermic injection of some medication, possibly quinine. There was no immediate reaction except slight induration but later marked induration and pain followed. Examination showed a well nourished woman with no abnormalities, except two or three small, hard, subcutaneous nodules about one centimeter in diameter in the subcutaneous fat over the insertion of the right deltoid muscle. They were not adherent to the muscular aponeurosis but were tender. Manipulation of them seemed to cause considerable pain, radiating to the fingers, two of which were slightly swollen. These masses were excised under anæsthesia and examination proved them to consist of many large and small cysts, containing clear oily fluid in fine droplets. Scrapings showed small numbers of fatty acid crystals, but there was no acid reaction.

This case is of doubtful nature and possibly should not be classed as fat necrosis. It may be that we have here an example of encysted oil collections from injections of camphorated oil or liquid petrolatum.

Case VII.—D. G., female, about thirty-five years of age, entered the Cornell division of the New York Hospital, in November, 1919, complaining of a small subcutaneous tumor on the posterior surface of the right arm about two inches above the elbow. She gave a history of a rather severe blow in that region five years previously, followed by considerable discoloration. A lump formed which has persisted ever since. Examination showed a stout, healthy, young woman, with a hard, probably calcareous nodule in the subcutaneous fat over the right triceps. It was only slightly tender, and scarcely if at all attached to the skin. This mass was excised by Dr. Kenneth Johnson of the Staff and healing was uneventful. Examination showed an encysted tumor mass almost completely calcified and containing some grayish-white material, similar to that observed in other cysts of this nature. Degeneration was so complete that the microscopic examination was very unsatisfactory. A completely calcified simple epidermoid cyst could not be excluded. Another confusing factor was the presence of two apparently similar but smaller calcareous nodules in the neck which would ordinarily have been classified as calcified cervical lymph-nodes, probably tuberculous in origin.

About a dozen other similar cases have been observed during the past seven years. All were recent in origin, due to fairly severe trauma and occurred in young, robust, and stout subjects. The tumor masses lasted for periods up to three months and then gradually disappeared or the patients no longer returned for observation. As these masses were causing no active symptoms, operative intervention was deemed unnecessary. There is little doubt, however, that in most of them we were dealing with traumatic subcutaneous fat necrosis of mild degree.

Such cases must be of fairly common occurrence and since the calcareous cysts described above are quite uncommon it must be that the great majority of them undergo spontaneous resolution and complete healing.

Subcutaneous fat necrosis is of little importance in itself, as its end results are either complete resolution or the formation of fibrous walled and calcareous cysts. The chief interest attached to the masses is that of differential diagnosis. The recognition of the possibility of fat necrosis in subcutaneous tissue is important and should be borne in mind along with the lipomata, neuromata and the granulomata. They will only rarely require surgical attention. The relation of traumatic fat necrosis to pancreatic fat necrosis may prove of considerable importance and is worthy of investigation. Its relation to cyst formation and possibly to true tumors should also be kept in mind.

Fat necrosis is therefore probably far more common than is suspected, in the brawny contusions of obese subjects, in broken-down lipomata, etc., and especially in operative wounds. Here it unquestionably must be a large factor in causing induration and probably also infection, as the presence of a foreign body, wherever found, favors the development of infection.

A number of cases of ischæmic fat necrosis, or better necro-biosis, have been shown. It has been proved comparatively easy to reproduce the condition in animals. No pancreatic disease or injury is necessary for the process of fat necrosis. Possibly no ferment action is concerned, the etiological factor being simply ischæmia. It is difficult to understand why fat necrosis in adipose children and in new-born infants is not extremely common. There probably is some other underlying factor which has been overlooked.

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Extracted from the American Journal of the Medical Sciences,
November, 1922, No. 5, vol. clxiv, p. 712

DELAY IN THE TREATMENT OF CANCER.[1]

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Several years ago the statistics on delay in the treatment of cancer as seen in the first surgical or Cornell division of the New York Hospital were investigated. The results were quite startling, to say the least. Our cases were coming so late and frequently in such hopeless condition that a determined effort was made to ascertain the causes of delay.

Over 100 consecutive cases were questioned at length as to the time lost after the initial symptoms, first, before consulting a physician, and second, before entering a hospital for study and treatment. Incidentally we classified the physician's advice as good or poor, accordingly as he urged operation or counseled delay and palliation. We then classified our cases under curable, probably curable, incurable, operable and inoperable headings.

From these findings, meager though they were, it was at once apparent that patients procrastinate and delay for a considerable time after symptoms develop, that the physician's advice is as frequently wrong as right, that another and longer period of delay ensues before entering hospital, and that our patients finally reach us in such an advanced stage that only palliative or life-prolonging treatment is possible.

These figures, as ascertained after most painstaking investigation, were read before a scientific society in this city and offered to the leading medical journal of the country. Much to our surprise the article was rejected as casting reflection on the profession, and was rather harshly criticized. It was, however, promptly accepted and printed by the leading scientific medical journal of the country. The facts as presented were verified and substantiated by numerous writers before and since that article appeared and the popular medical journal reviewed the article at considerable length with no word of criticism.

Recently a further investigation has been made of approximately 250 additional cases, and the results are too strikingly similar to be very inaccurate. It must be remembered that the

[1] Read before the Society for the Control of Cancer, November 7, 1921.

facts were obtained by many different men, working in ignorance of any desired goal, and that the tabulations and comparisons have been made by still other men, selected for their special knowledge and training, but not the responsible surgeons in charge. In this way personal bias has been, we hope, to a large degree eliminated. Inaccuracies naturally will creep into such a compilation, but we trust and believe that we have approximated the truth.

Our findings are that a delay of approximately one year occurs in the average case before adequate surgical care is sought. This means a year of delay after the development of symptoms or the appearance of a growth. Unquestionably the growth is always present for some time before symptoms or the tumor appears.

From the surgical standpoint we can state emphatically that nearly all cancers or malignant tumors are curable by the knife or other destructive measures if seen early enough. Unfortunately a considerable proportion of cases occur in deep-seated, inaccessible or non-symptom-giving locations. In such instances it is but natural that we rarely see curable cases. Mistakes in diagnosis here are also readily understood and are forgivable.

From the standpoint of our present knowledge the only hope of increasing our percentage of cures lies in obtaining cases earlier in the disease. We must shorten the time from the patient to the physician and from the physician to the hospital; possibly even we can shorten the time lost before symptoms develop by regular, systematic, complete physical examinations at not too infrequent intervals. This last idea, I fear, is quite utopian at present.

We can and must, however, reach our patients earlier, before the disease has spread beyond possible removal. The physical limits of operative removal have surely been nearly if not quite attained. Progress can come only by shortening the time preceding operation.

Education of both the laity and, I regret to say, the physicians must be pushed to the point where only wilful self-neglect can prevent timely proper treatment and a very high percentage of cures. Cancerphobia or hysteria must be avoided, of course, and grewsome discussions of neglected cases are not usually helpful. In general a calm, rational, thoughtful statement is more effectual than hysterical or alarmist appeals. After all, patients are quite reasonable in their views of health and disease if only given a fair insight into conditions.

Such methods of propaganda have been used repeatedly here and elsewhere on similar subjects, and with marked success. We firmly believe that a like success will follow sincere and earnest work in this field also. Teamwork, persistence, tact and courage will accomplish as much in our cancer work as they have in the antituberculosis campaign and in general hygiene.

Preventive treatment of malignancy offers a very hopeful field for research and practical application. We do not know the cause of cancer, but we do know what underlying conditions favor its implantation and growth. Such conditions are frequently amenable to simple and safe remedies. A trivial operation for the removal of an innocent growth, a small but persisting ulcer, a fissure, an irritated scar, etc., may prevent a severe and mutilating procedure a few years later. Even the adoption of a simple, proper diet, good hygiene and the avoidance of all excesses in eating, drinking, smoking, etc., may well be considered preventive measures against cancer. Delay in the use of the simple remedy is as foolish as in definitely established growths, or more so, as preventive cures are so infinitely safer and more sure than remedial attacks.

Resume of Cases. One hundred and fifty cases gave *time lost* after symptoms developed and before consulting a physician from no time to ten years. Average time, twenty-four weeks.

Time from onset of symptoms to time of consulting physician obtained in 150 cases. One of these, a slow-growing sarcoma of the arm of twenty-five years' duration, is not included in the average. Others range from no time lost to ten years; 79 consulted a physician in one month or less from the onset of symptoms. Average time, twenty-four weeks.

Time from Consulting Physician to Time of Entering Hospital. Obtained in 141 cases. Ranges from no time lost to nine years. With one exception all who waited over one year were cases in which the physician gave wrong advice. This was a woman with carcinoma of the cervix who waited seven years; 68 entered the hospital within one month from the time of consulting a physician. Of these all but 3 were advised correctly. Average time, twenty-four weeks.

Time from onset of symptoms to time of entering hospital in those cases in which it was not stated when the physician was consulted, 90 cases, excluding those given above. Average time, fifty-five weeks.

PHYSICIAN'S ADVICE:

	Total.	Right.	Wrong.
Number curable	43	32	11
Probably curable	24	13	11
Incurable	83	39	44
Operable	74	51	23
Inoperable	76	33	43

I wish to express my thanks to Dr. Charles L. Gibson for the privilege of publishing these statistics, as all the cases occurred in his service and were operated by him and the other members of the attending staff of the first surgical or Cornell division of the New York Hospital. I wish also to thank Dr. Morris Weeden for assistance in collecting the statistics and tabulating them.